FORT ORD, CALIFORNIA

(INCLUDING FORT HUNTER LIGGETT, CAMP ROBERTS
AND PRESIDIO OF MONTEREY)

TERRAIN ANALYSIS

PREPARED BY
DEFENSE MAPPING AGENCY HYDROGRAPHIC/TOPOGRAPHIC CENTER
WASHINGTON, D.C.
FOR
THE TERRAIN ANALYSIS CENTER
U.S. ARMY ENGINEER TOPOGRAPHIC LABORATORIES
FORT BELVOIR, VIRGINIA 22060

JUNE 1980

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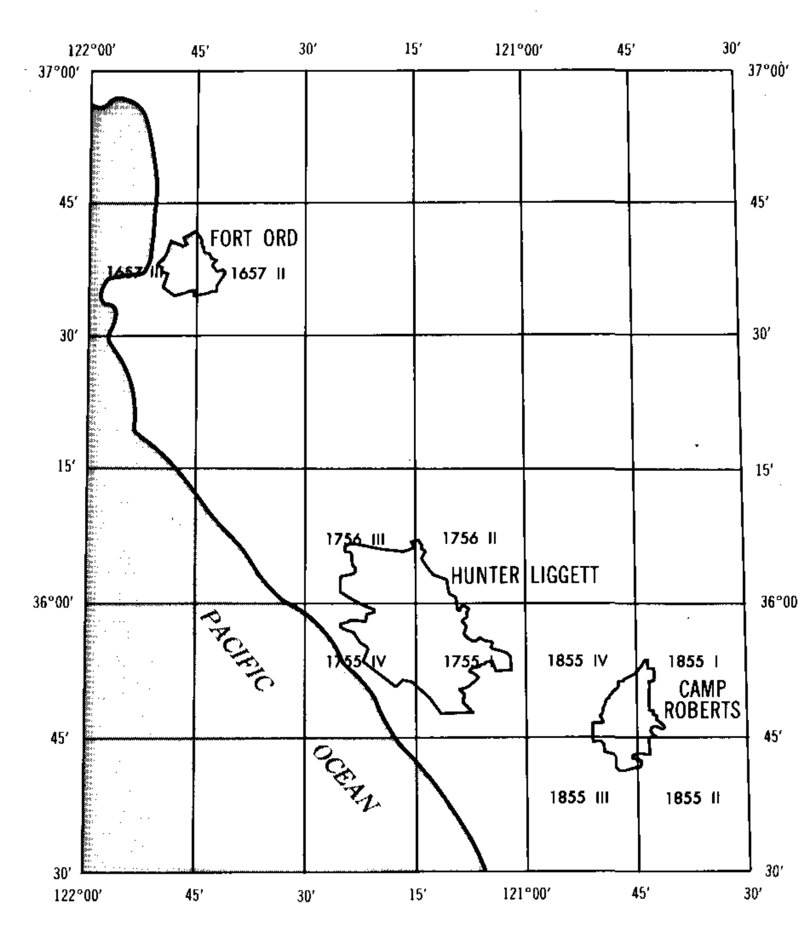
TERRAIN ANALYSIS

TABLE OF CONTENTS

SERIES V795
1:50,000 SHEET INDEX
AND
LOCATION DIAGRAM



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I. INTRODUCTION

BACKGROUND

The requirement for this terrain analysis of Fort Ord was stated in message P2418542, Oct. 1975, from the Commander, FORSCOM, to the Office Chief of Engineers (OCE), Department of the Army, subject: "Terrain Analysis of Selected FORSCOM Installations." The FORSCOM requirement identified the installations, including Fort Ord, and cited topical coverage to be included in the studies. Responsibility for management and supervision of the program developed in response to the FORSCOM requirements was assigned by OCE to the Terrain Analysis Center (TAC), U.S. Army Engineer Topographic Laboratories. At FORSCOM's request, TAC responsibility also includes technical supervision and direction of FORSCOM troop units assigned to the program.

Scope and content of the topical coverage included in the FORSCOM requirement were developed jointly between representatives of TAC and FORSCOM Headquarters. Fort Hunter Liggett and Camp Roberts, sub-installations of Fort Ord, were added to the original requirements by FORSCOM at the request of Fort Ord. Analytical and cartographic specifications for the studies were developed by TAC, coordinated with OCE and concurred in by FORSCOM Headquarters.

This study was prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington D.C. for the Terrain Analysis Center (TAC) of the U.S. Army Engineer Topographic Laboratories (ETL), Fort Belvoir, Virginia.

PURPOSE

In stating the requirement for terrain analyses of selected installations FORSCOM indicated that the purpose of the program is to assist military planners in future stationing decisions. To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes, among many other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles. The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies.

Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity. These things are also treated in the studies.

Since the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental. While some of the information contained in the studies may be useful as environmental base line data, the studies are by no means complete environmental inventories of the kind required in support of environmental impact assessments.

SCOPE

In scope, the terrain analysis is a compendium of available data on the pertinent natural and man-made features of the reservation and an evaluation of their effects on tactical military operations. The program does not include basic research to fill gaps in these data, although some short-term field investigations were performed to obtain ground truth and a general overall appreciation of terrain elements. Therefore, the scope of the analysis is limited primarily to those factors which have been documented by other authorities and to the results of analysis and evaluation of those factors by senior terrain analysts for topics such as cross-country movement, cover and concealment and water resources.

The terrain analysis preparation process has necessarily involved analytical judgement in the selection of pertinent source data, resolution of data conflicts, recognition of interrelationships not previously made explicit, and the application of remote sensing to update certain critical, time-variant data such as vegetative cover and man-made features including roads, airfields, and facilities constructed outside of the cantonment areas.

LIMITATIONS

The study naturally reflects limitations in the quality, amount, and currency of the source data on which it is based. Numerous field interviews and selective use of remote sensing were employed in an effort to assure presentation of the latest and best information. Within the relatively complex topical scope of the analysis, however, there are a number of aspects on which source data have not been generated with the focus or recency desired to meet objectives fully. As noted under SCOPE, the study effort was not designed to include basic research as a means of filling gaps in data.

By design, the presentation is cast at a level of data coverage consistent with stated objectives. Users interested in deeper pursuit of data are referred to the List of Sources in the back of the study.

PRESENTATION

Maximum use of graphic presentation has been made throughout the terrain analysis. Supporting text is, as far as practical, in tabular format keyed to the related graphics which follow. The primary map scale is 1:50,000. For Urban Areas (Cantonment Areas) larger scale maps are used and for Off-Post Features the map scale is 1:1,000,000.

STUDY AREA

The study area encompassed by this analysis includes Fort Ord, Presidio of Monterey, Fort Hunter Liggett and Camp Roberts. All are located in central California. Presidio of Monterey, Fort Hunter Liggett and Camp Roberts are sub-installations of Fort Ord. Presidio of Monterey is the "Home of the Defense Language Institute," Fort Hunter Liggett is used as a field laboratory and training area and Camp Roberts is licensed to the California National Guard. Presidio of Monterey was considered under the topics of Lines of Communication and Urban Areas (Cantonment Areas) only, and has been included in the Fort Ord presentation. The remaining two sub-installations are treated separately within this study for purposes of user convenience.

FORT ORD, 11,413 hectares (28,201 acres) including Presidio of Monterey, is located adjacent to the city of Monterey among rolling hills of stabilized sand between the Salinas Valley and Monterey Bay. Vegetative cover is characterized by scrub oak, brush and grasses. Drainage on post is by small tributaries to the Salinas River. The tributaries are fed primarily by runoff during the rainy winter months. The climate at the installation is generally moderate with mild winter temperatures and gentle breezes.

FORT HUNTER LIGGETT, 67,397 hectares (166,535 acres) is located in the Santa Lucia Mountain Range 96 kilometers (60 miles) south of Fort Ord. This installation is drained by the San Antonio and Nacimiento Rivers and their tributaries. Generally, water flow is slight except during periods of winter floods. While vegetation on the reservation is predominantly mixed scrub and deciduous forest, extensive and continuous areas of grass exist, particularly in the larger valleys. Summers at Hunter Liggett are warm and dry, winters cool and humid.

CAMP ROBERTS, is located 48 kilometers (30 miles) southeast of Fort Hunter Liggett. Its boundaries encompass 17,807 hectares (44,000 acres) of area astride the Salinas River Valley between the Santa Lucia Mountain Range to the west and California's Coastal Ranges to the east. Terrain is characterized by low hills and high and low plains. The Salinas, Nacimiento, and San Antonio Rivers form the major drainage network. The flows of the San Antonio and Nacimiento are governed by water releases from the Nacimiento and San Antonio Reservoirs located a few kilometers west of the reservation. Vegetation cover is primarily short grasses and deciduous forest. Climate year-round is mild with warm temperatures.

FORT ORD

II DESCRIPTION AND MILITARY ASPECTS OF TERRAIN

A. SURFACE CONFIGURATION

Fort Ord is in central California on Monterey Bay in the California Coast Range section of the Pacific Border physiographic province. Landforms consist of low, flat to gently rolling plains in the northern third of the reservation, gently rolling to strongly rolling high plains in the southern two-thirds and low rounded hills in the southeastern corner of the reservation. The low and high plain surfaces are largely recent sand dunes near the coast and stabilized dunes in the interior. The low hills surfaces are smooth with very little rock outcrop. There is little or no stream dissection on most of the post, except in the eastern third where streams generally trend northeastward and southeastward.

MAP UNIT	LANDFORM	LANDFORM DESCRIPTION AND DISTRIBUTION	ELEVATION
1	Low Plains	Flat to gently rolling smooth surfaces predominate in the northern third of the reservation; there is little or no stream dissection. The flattest areas are along the narrow sandy coastal beach on Monterey Bay in the extreme northern part and along the Salinas River; here, local relief reaches about 25 m (82 ft) and slopes are largely between 0 and 3%. Gently rolling areas cover the remainder of the low plains and consist largely of recent sand dunes and hummocks behind the beach, and further inland, old stabilized dunes with numerous interdunal depressions; local relief from the tops of dunes to depressions is mainly between 25 and 50 m (82 and 164 ft); slopes are largely between 3 and 8% and in interdunal depressions mainly from 0 to 3%.	Elevations are mostly between 30 and 120 m (100 and 400 ft) above sea level. Lowest elevation, sea level, is along coast. Highest elevation, 150 m (492 ft) above sea level, is in the extreme southern part of plains.
2	Low Hills	Smooth to moderately dissected, gently to strongly rolling surfaces predominate in most of the southern two-thirds of the reservation; local relief is mainly between 70 and 145 m (230 and 475 ft); slopes are commonly between 3 and 15%. Smooth, gently rolling surfaces of old stabilized dunes cover most of this unit, except in the extreme eastern part; there is little or no stream dissection; numerous nearly flat interdunal depressions occur; local relief is mainly 50 to 120 m (164 to 394 ft); slopes are largely 3 to 15%. In the extreme eastern part, moderately dissected, strongly rolling, surface predominate; stream valleys trending northeastward; local relief is largely between 120 and 150 m (394 and 492 ft); slopes are largely 8 to 15%, locally up to 30%.	Elevations are largely between 90 and 245 m (300 and 800 ft) above sea level. Lowest elevation is 25 m (82 ft), near Hayes School in the extreme western part of unit. Highest elevation, 284 m (930 ft), occurs in the southcentral part of unit.
3	High Plains	Rounded low hills with smooth to moderately dissected surfaces predominate in the southeastern corner of the post; narrow stream valleys trend northeastward; locally rock outcrops occur along steeper valleys in the central part; local relief generally 150 m (492 ft) or slightly higher; slopes are mainly between 15 and 30%; locally, some slopes are as low as 8% and as high as 45%.	Elevations are largely between 120 and 245 m (400 and 800 ft). Lowest elevation, 58 m (192 ft), is in Pilarcitos Canyon. Highest elevation, 270 m (885 ft), is on western edge of unit.

B. SURFACE DRAINAGE

The drainage pattern of Fort Ord is not well developed since most of the runoff drains into the sand and gravel that cover the post. This is particularly true of the western half of the reservation. In the eastern portion, a series of intermittent and ephemeral streams carry the occasional runoff northeastward to the northwestward-trending Salinas River channel. The Salinas River flows perennially since upstream reservoirs assure a year round supply of water. The Arroyo Del Rey and El Toro Creek frequently flow with a discharge of less than 0.03 m^3/sec (1.0 ft^3/sec), with short dry periods during July through September; discharge rates in excess of 0.3 m^3/sec (10 ft^3/sec) have been recorded during periods of heavy precipitation.

The Salinas River is near the northeastern boundary of the reservation and passes through a small portion of the reservation just west of the State Highway 68 and River Road intersection. Farther north, near Fritzsche Army Airfield, the west bank forms part of the boundary.

Fort Ord has a number of small impoundments that normally contain water from January through July and are used to water livestock on the post.

DRAINAGE CHARACTERISTICS

DRAINAGE CATEGORIES	GENERAL	REGIME	WIDTH	DEPTHS	VELOCITY AND DISCHARGE	BANKS	BOTTOMS
Water Courses							
Salinas River	Perennial river that flows northwesterly from the vicinity of San Luis Obispo to the Pacific Ocean at or near the northeastern boundary of the reservation. River valley is relatively flat and narrow; 4 to 10 km (2.5 to 6 mi) wide and bordered by low plains on both sides.	High water months are February and March; low water occurs from June through November. No flooding occurs.	The channel falls in the 15 to 25 m (49 to 82 ft) range.	Rarely exceeds 1 m (3.3 ft)	Velocity is generally less than 0.5 m/sec (1.7 ft/sec). Near Spreckles, discharge averages 25.7 m^3/sec (906.6 ft^3/sec) December through April and about 0.84 m^3/sec (29.7 ft^3/sec) May through November.	Low and gently sloped along most of the river. Scattered areas of steep banks (west bank near the airfield). Sand and gravel predominant material with isolated pockets of silt.	Sand with gravel with some scattered silt. Gradient is very gentle.
El Toro Creek	Intermittent stream flowing along the southeastern border of the post. El Toro Creek flows through low hills in a narrow valley which is less than 0.5 km (0.33 mi) wide at its widest point. The valley floor is generally flat.	High water months are January through April and low water months are May through December. Stream beds may be dry for varying periods, primarily from July through September.	Channels are generally in the 10 to 15 m (33 to 49 ft) range. Other channels are mostly less than 3 m (10 ft).	Less than 1 m (3.3 ft)	Velocity is generally less than 0.5 m/sec (1.7 ft/sec). Near Spreckles, discharge averages 0.134 m^3/sec (4.7 ft^3/sec) December through April and about 0.005 m^3/sec (0.016 ft^3/sec) May through November.	Generally steep to very steep. In many places banks blend into hill sides with no perceptible break. Sand and gravel predominant materials.	Where bottoms are well-defined, sand and gravels predominate.
Standing Bodies of Water							
Reservoirs (See tables below)							

RESERVOIRS

MAP NUMBER	NAME*	GRID COORDINATES	APPROXIMATE HECTARES (ACRES)
1	[Gigling Siding Lake]	052571	0.08 (0.19)
2	East Garrison Lake	127566	0.96 (2.4)
3	[Golf Course Lake]	062536	0.2 (0.49)
4	Mudhen Lake	133541	4.0 (10.0)
5	[Merrilis Hill Lake]	108529	2.7 (6.7)
6		123523	0.04 (0.09)
7	[Pilarcitos Canyon Lake[1]]	138525	0.2 (0.49)
8	[Bingamin Ranch Lake]	150517	0.85 (2.13)
9	[Pilarcitos Canyon Lake[2]]	131512	0.24 (0.59)
10	[Pilarcitos Canyon Lake[3]]	127509	0.16 (0.39)
11	[Wolf Hill Lake]	115499	1.96 (4.9)
12		139502	0.096 (0.29)
13	[Guidotii Ranch Lake]	138491	0.036 (0.09)

*Bracketed names assigned to unnamed reservoirs for clarity.

MAXIMUM STREAM DISCHARGE

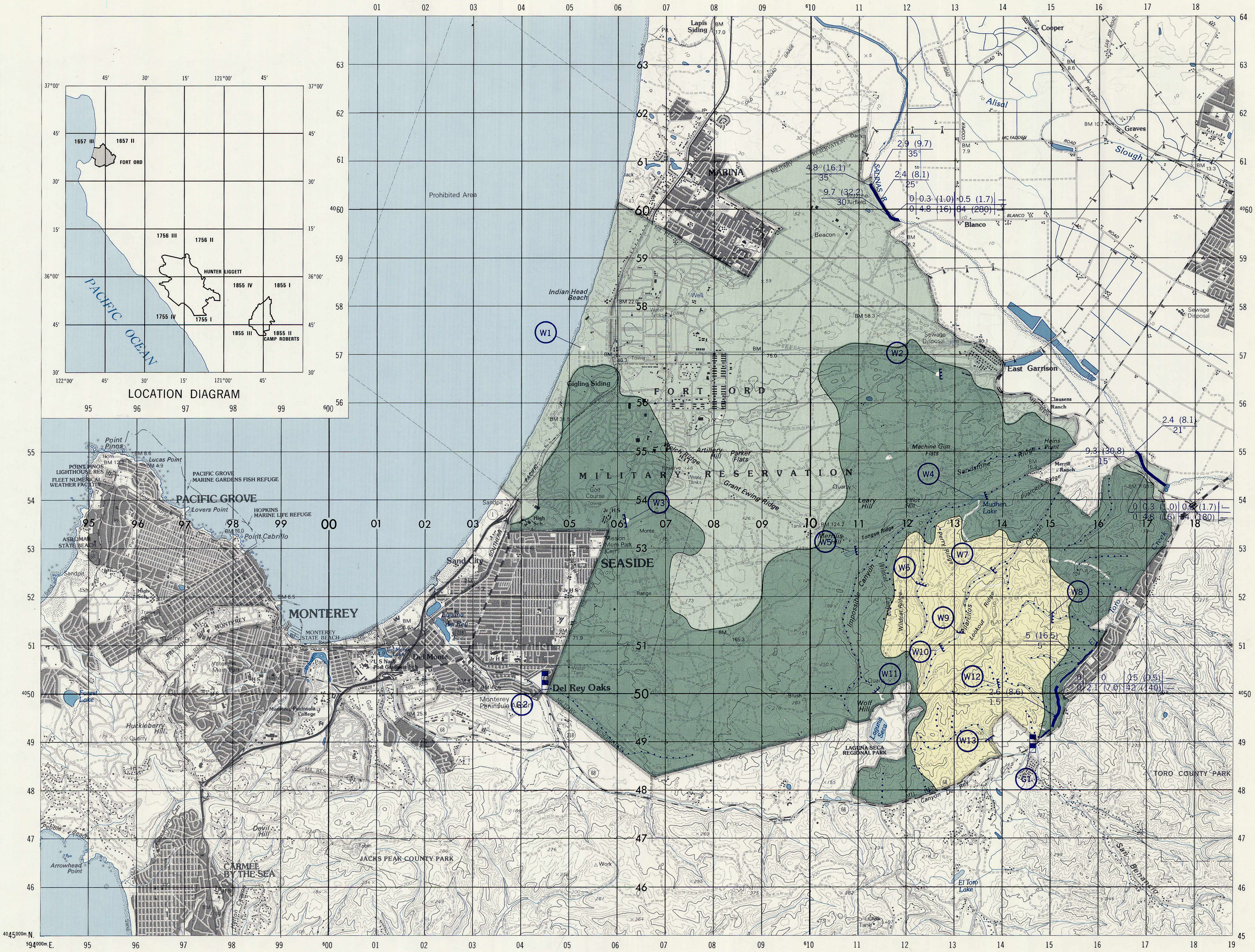
GAGING STATION MAP NO.	STREAM NAME	DRAINAGE AREA ABOVE GAGE km^2 (mi^2)	RECORDING PERIOD	MAXIMUM MEAN MONTHLY DISCHARGE m^3/sec (ft^3/sec)	DATE
*	Salinas River	10,908 (4156)	OCT 1929 – SEPT 1976	358 (11,940)	FEB 1938
1	El Toro Creek	84 (32)	OCT 1961 – SEPT 1976	0.44 (14.8)	FEB 1968
2	Arroyo Del Rey	36 (14)	OCT 1966 – SEPT 1976	2.3 (77.8)	FEB 1968

*Salinas River gaging station not shown on map. It is located at Spreckels, 1.8 km (1.1 mi) upstream of Fort Ord boundary.

MEAN MONTHLY DISCHARGE

m^3/sec (ft^3/sec)

MONTH	EL TORO CREEK NEAR SPRECKELS, CA. (OCT 1961 – SEPT 1976)	ARROYO DEL REY AT DEL REY OAKS, CA. (OCT 1966 – SEPT 1976)	SALINAS RIVER NEAR SPRECKELS, CA. (OCT 1929 – SEPT 1976)
January	0.116 (4.096)	0.028 (0.996)	22.5 (793.8)
February	0.229 (8.068)	0.073 (2.564)	44.2 (1561.3)
March	0.127 (4.474)	0.061 (2.157)	35.6 (1256.0)
April	0.062 (2.174)	0.032 (1.118)	18.6 (655.3)
May	0.007 (0.251)	0.004 (0.153)	2.7 (95.2)
June	0.004 (0.128)	0.005 (0.187)	0.782 (27.6)
July	0.002 (0.085)	0.007 (0.241)	0.321 (11.32)
August	0.002 (0.065)	0.002 (0.067)	0.143 (5.04)
September	0.002 (0.061)	0.007 (0.232)	0.546 (19.28)
October	0.002 (0.068)	0.002 (0.073)	0.640 (22.58)
November	0.006 (0.221)	0.009 (0.314)	0.753 (26.57)
December	0.017 (0.551)	0.007 (0.249)	7.554 (266.75)



FORT ORD, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS

SUPPLEMENTARY CONTOURS 10 METERS

SURFACE CONFIGURATION

1. **LOW PLAINS** — Predominantly flat to gently rolling flood plains and gently to moderately rolling plains elsewhere. Local relief mainly between 20 and 40 m; slopes seldom greater than 3%.

2. **HIGH PLAINS** — Predominantly moderately rolling to hillocky plains. Local relief mainly between 50 and 100m; slopes are commonly 3 to 15%.

3. **LOW HILLS** — Predominantly low hills with local relief mainly between 100 and 150m. Slopes are commonly 15 to 30%.

SURFACE DRAINAGE

BANK TO BANK GAP WIDTH

> 25m

15-25m

10-15m

< 3m

5 (16.5) / 5° — Bank height/slope, in m(ft)/degrees

0	0.3 (1.0)	0.5 (1.7)	—	Depth low	Normal	Bankfull	High, estimated in m(ft)
0	4.8 (16)	54 (180)	—	Width low	Normal	Bankfull	High

Earth dam

W3 Reservoir

G1 Gauging station

NOTE: Number refers to entries in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

C. WATER RESOURCES

1. SURFACE WATER

Most of the area south of San Francisco receives rain only during the winter months, and during the remaining months practically no rain falls. The Salinas River, the Arroyo Del Rey and El Toro Creek are the only streams on Fort Ord which are perennial; however, water flow is as low as 0.3 liters per minute (6,450 gallons per day) during the summer months in the Arroyo Del Rey and El Toro Creek. Before construction of two dams approximately 103 km (64 mi) upstream from Fort Ord on the San Antonio and Nacimiento Rivers, surface flow was intermittent in the Salinas River, although there was subsurface flow throughout the year in the Salinas Valley. Flow is now regulated at these dams to maintain a minimum continuous flow and to dilute the waste irrigation water with its high chemical content. On Fort Ord most surface water features are found on the southeastern third of the post, in the high plains and low hills regions. The surface material on the rest of the reservation consists primarily of sand and gravel. Consequently, precipitation generally seeps down through the surface, except where small temporary ponds are formed in interdunal depressions. The quality of surface water at Fort Ord is generally good. A land disposal plan for controlling Fort Ord's sewage has been implemented in the Natural Resources Program. This program has given considerable thought to water conservation in the design of the landscape. Vegetation is planted to absorb the nutrients in the effluent and transpire the moisture. Only small amounts of effluent percolate through the soil into aquifers. Data on quantity and quality of surface water is rather limited.

SOURCES	QUANTITY	QUALITY	ACCESS AND DEVELOPMENT
The Salinas River flows on the eastern edge of Fort Ord for approximately 1 km (0.6 mi) through low plains to the east and high plains to the west. This portion of the Salinas River is approximately 9 km (5.6 mi) from the reservation's populated area. In the northern portion of the post, the Salinas River borders Fort Ord, flowing in a northwesterly direction near Fritzche Army Airfield with low plains on either side of the river. This portion of the river 1 km (0.6 mi) is approximately 3 km (3 mi) from the reservation's populated area.	The Salinas River affords more than 5,964,000 liters per minute (3.26×10^9 gpd) from Dec thru Apr. From May thru Nov it affords more than 114,000 liters per minute (4.33×10^7 gpd).	Natural surface waters are good but might be degraded by municipal waste. Natural stream waters are hard and high in total dissolved solids. In addition, sulfates and bicarbonates as well as calcium, magnesium and sodium are found in this water. Suspended sediment load varies with the season and is high during high-water periods.	Access to the northern and eastern portions of the Salinas River are characteristically the same. Its western banks are relatively steep (up to 45%) and bank heights are generally 5 m (16.4 ft). Its eastern banks are part of a flood plains region where bank heights are generally 3 m (10 ft). Both portions of the river border Fort Ord for approximately 1 km (0.6 mi) and are about 15 to 25 m (48 to 82 ft) wide. Depths are generally less than 1 m (3.3 ft).
El Toro Creek, located on the southeast edge of Fort Ord, flows in a northeasterly direction for approximately 3 km (1.9 mi). It is in a valley system with low hills on either side. This stream is approximately 8 km (5 mi) from the populated area of Fort Ord.	El Toro Creek affords more than 6500 liters per minute (2,473,000 gpd) from Dec thru Apr. From May thru Nov it affords more than 200 liters per minute (76,000 gpd).	Based on regional considerations, it is likely that natural stream waters are hard, high in dissolved solids and slightly corrosive in the low hills region. Sources of municipal and industrial waste are absent. Some bacteria may collect in small ponds, and suspended sediment load may be present during high water periods.	El Toro Creek is located in a valley system with flood plains approximately 0.5 km (0.3 mi) wide. Its banks are gently sloped and generally less than 2.5 m (8.2 ft).
The Arroyo Del Rey flows for approximately 1 km (0.6 mi) within the southwestern boundary of Fort Ord. It flows in a northwesterly direction in a low plains region and is approximately 4 km (2.4 mi) from the populated area.	The Arroyo Del Rey affords more than 2400 liters per minute (913,000 gpd) from Dec thru Apr. From May to Nov it affords more than 302 liters per minute (115,000 gpd).	No data available (not used for human consumption).	Access to the Arroyo Del Rey is generally good from the adjacent low plains with gently rolling slopes and bank heights less than 2 m (6.6 ft).
Lesser tributaries and ponds, spaced from 1 to 2 km (0.6 to 1.2 mi) apart, are mostly located in the southeastern and central regions of the post approximately 4 km (2.5 mi) away from the populated area. Most tributaries occur in the low hills region. Only the Salinas River and El Toro Creek have any flood plain development. Most other tributaries are located in relatively steep valleys and exhibit some gullying.	In the shallow drainage channels and gullies, water flow occurs only during rains and for a few hours thereafter. Water may also be present as a series of pools and behind earthen dams. However, most ponds are dry during the summer season.	No data available (not used for human consumption).	Access to these streams, ponds, and earthen dams presents no problem since they are located among rolling hills and interdunal depressions. The depressions often hold water and may be considered ponds. Most ponds are about 1 hectare (2.5 acres) in size or smaller.

ANALYSES OF SURFACE WATERS, FORT ORD

Map Unit	Stream Name and Date	ph (Units)	Bicarbonate HCO_3 MG/L	Hardness Ca, Mg MG/L	Non Carbonate Hardness MG/L	Dissolved Calcium (Ca) MG/L	Dissolved Magnesium (Mg) MG/L	Dissolved Sodium (Na) MG/L	Dissolved Potassium (K) MG/L	Dissolved Chloride (Cl) MG/L	Dissolved Sulfate (SO_4) MG/L	Dissolved Silica (SiO_2) MG/L	Dissolved Nitrate (NO_3) MG/L	Dissolved Fluoride (F) MG/L	Carbonate CO_3 MG/L
1	*Salinas River	Avg 7.5	304	296.7	50.7	69.1	30.5	101.6	15.0	114.3	105.3	30.3	--	0.7	0
	Water Year Oct 1975 to Sep 1976 Range	6.4 - 7.9	163 - 522	210 - 400	0 - 100	51 - 100	21 - 37	50 - 140	4.6 - 28	43 - 150	64 - 160	14 - 45	--	0.2 - 3.7	0

Map Unit	Stream Name and Date	Specific Conductance (Micro-Mhos)	Total Phosphorus (P) MG/L	Total Arsenic (As) UG/L	Total Cadmium (Cd) UG/L	Total Chromium (Cr) UG/L	Total Cobalt (Co) UG/L	Total Copper (Cu) UG/L	Total Lead (Pb) UG/L	Total Mercury (Hg) UG/L	Total Zinc (Zn) UG/L	Pesticides UG/L	Dissolved Solids Tons/AcFt	Dissolved Boron (B) UG/L	Fecal Coliform Col/100ML	Fecal Streptococci Col/100ML	Temperature C°
1	*Salinas River	1095.9	6.6	7.5	--	20	--	42.7	--	.15	55	+	0.9	--	**607.8	64.5	16.1
	Water Year Oct 1975 to Sep 1976 Range	670 - 1470	0.49 -12	6 - 0	0 - <10	0 - 50	0 - <50	30 - 58	10 - <100	.1 - .2	50 - 60	+	0.58 - 1.06	--	83 - 2300	38 - 91	11 - 22

+ The only pesticides detected occurred on May 04, 1976, when .04 UG/L of DDE and .10 UG/L of DDT were measured.

* This gaging station is located at Spreckels, 1.8 km (1.1 mi) upstream from Fort Ord boundary.

** Coliform analyses are being discontinued at this station because no water is withdrawn for human consumption from this station to the month of the Salinas River.

NOTE: MG/L is milligrams per liter; UG/L is micrograms per liter.

PRODUCTION WELL DATA, 1977

WELL NUMBER*	LOCATION GRID REFERENCE	DEPTH meters	(feet)	MAXIMUM DAILY CAPACITY liters (000)	gallons (000)	AVERAGE DAILY PRODUCTION liters (000)	gallons (000)	REMARKS
1 (11)	076584	232	(760)	2180	576	416	111	
2 (14)	079585	215	(706)	3543	936	1363	360	
3 (18)	081584	152	(500)	4088	1080	416	110	
4 (19)	078581	98	(320)	2725	720	1022	270	
5 (21)	085586	88	(290)	4906	1296	3607	953	
6 (23)	074588	87	(286)	5069	1339	1806	477	
7 (24)	089586	123	(405)	4906	1296	1630	430	
8 (25)	090588	125	(410)	4906	1296	790	210	
9 (26)	092592	124	(407)	4906	1296	1690	447	
10 (27)	093594	171	(560)	1393	368	1460	387	
11 (28)	094592	137	(450)	1393	368	1730	457	
12 (3)	136566	no data		1553	410	50	130	East Garrison
13 (17)	137567	105	(343)	1919	507	50	130	East Garrison
14 (OV1)	046534	229	(750)	1717	454	420	111	Not drinking water-used for irrigation
15 (Golf Course)	048538	no data		2180	576	700	184	Not drinking water-used for Golf Course
			TOTALS	47,384	12,518	17,154	4,532	

*Well numbers in parentheses are Fort Ord designators.

TEST WELL CHARACTERISTICS

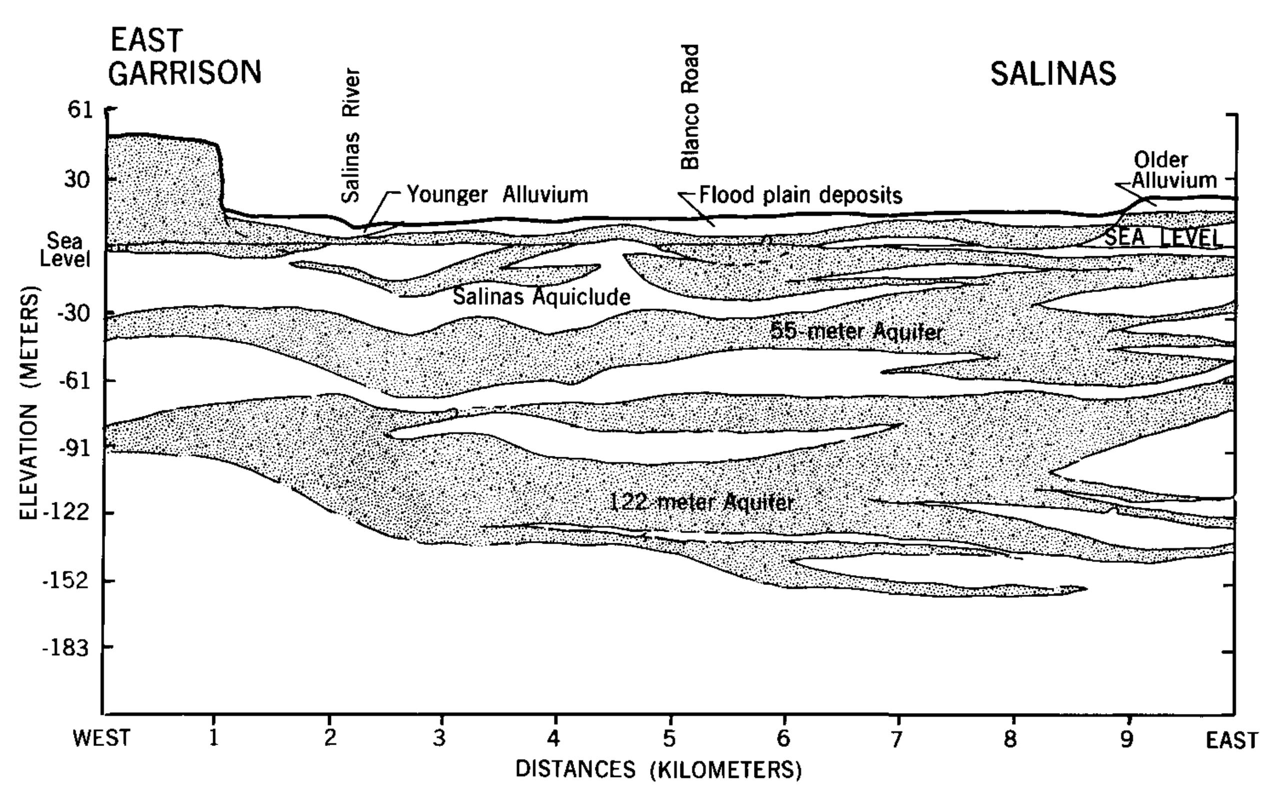
CONSTRUCTION	WELL 1	WELL 2	WELL 3	WELL 4
Grout surface seal (depth)	20 ft	20 ft	20 ft	20 ft
Well depth	580 ft	550 ft	520 ft	542 ft
Bit diameter	15 in	15 in	15 in	15 in
Casing – 8" I.D. blank	327 ft	347 ft	352 ft	382 ft
– 6⅝" O.D. blank	40 ft	30 ft	5 ft	40 ft
– 6⅝" O.D. blank	50 ft	50 ft	30 ft	70 ft
Screen depth intervals	325 – 350 ft 375 – 385 ft 395 – 410 ft	345 – 355 ft 370 – 400 ft 410 – 420 ft	350 – 380 ft	380 – 430 ft 465 – 485 ft
Developing and Testing				
Air development	8 hr	8 hr	8 hr	8 hr
Developing pumping and testing	29 hr	30 hr	6 hr	15 hr
Test rates, drawdown	165 gpm, 1.5 ft 265 gpm, 2.6 ft 330 gpm, 3.6 ft 410 gpm, 4.3 ft	130 gpm, 26 ft 245 gpm, 29 ft 275 gpm, 31 ft	½ gpm, 41 ft	70 gpm, 23 ft
Specific capacity	96.4 gal/ft @ 410 gpm	8.4 gal/ft @ 245 gpm		3.0 gal/ft @ 70 gpm
Approximate Elevations*				
Collar	173.0	250.0	280.0	287.0
Depth to water	183.7	263.0	316.5	301.0
Water surface	–10.7	–13.0	–36.5	–14.0

*Wells have not been surveyed. Collar and water surface elevations may vary ±15 feet.

REPRESENTATIVE DRILLING LOG IN THE
SALINAS VALLEY PRESSURE AQUIFER
TEST WELL NO. 1

DEPTH meters	(feet)	DESCRIPTION
0.0	(0.0)	Sand, orange-brown very fine- to fine-grained, subrounded to subangular.
1.8	(6.0)	Sand, light tan, fine-grained, subrounded to subangular.
6.1	(20.0)	Sand, light tan, very fine-grained with traces of medium grained sand, subrounded to subangular.
36.6	(120.0)	Sand, light tan, very fine- to fine-grained, subrounded to subangular with trace of clay, light brown.
39.6	(130.0)	Clay, brown, stiff, moderately to highly plastic, densest at 42 m (137 ft).
45.7	(150.0)	Sand, light tan, very fine- to fine-grained, subrounded to subangular.
48.8	(160.0)	Sandy clay, light brown, stiff, moderately plastic with trace very fine sand.
54.9	(180.0)	Sand, with cemented zones. Sand is light brown, very fine- to fine-grained, subrounded to subangular.
61.0	(200.0)	Sand, light tan, very fine- to fine-grained, subrounded to subangular with increase in dark grains from 67 to 73 m (220 to 240 ft).
97.5	(320.0)	Sand, tan, fine- to coarse-grained, rounded to angular, mostly coarse grained.
100.6	(330.0)	Gravelly sand with scattered cobbles. Sand is tan, fine- to coarse-grained, rounded to angular. Gravels are mostly pea gravel size, recovered as angular chips.
106.7	(350.0)	Sand, tan, fine- to coarse-grained but grading finer, rounded to subangular.
109.7	(360.0)	Sand, tan, fine- to coarse-grained but mostly fine to medium grained, rounded to angular. Slightly cemented at 110 to 116 m (360 and 380 ft).
125.0	(410.0)	Sand, tan, mostly medium grained with a cemented zone at 127 m (418 ft).
134.1	(440.0)	Gravelly sand, tan, sand is fine- to coarse-grained, mostly coarse-grained, angular. 10 – 15% pea gravels, rounded to angular.
140.2	(460.0)	Clayey sand, reddish brown, soft.
143.3	(470.0)	Sand, tan, fine- to coarse- grained, mostly medium-grained, angular to subangular.
158.5	(520.0)	Trace clay. Slight bluish color in drill fluid.
161.5	(530.0)	Sand, light brown, fine- to medium-grained, subangular.
167.6	(550.0)	Sandy clay, light brown, medium to highly plastic with a trace fine sand.
176.8	(580.0)	Bottom of hole.

DIAGRAMMATIC SKETCH OF THE SALINAS RIVER VALLEY EAST OF FORT ORD, SHOWING TYPICAL RELATIONSHIP OF MAJOR GROUND WATER UNITS



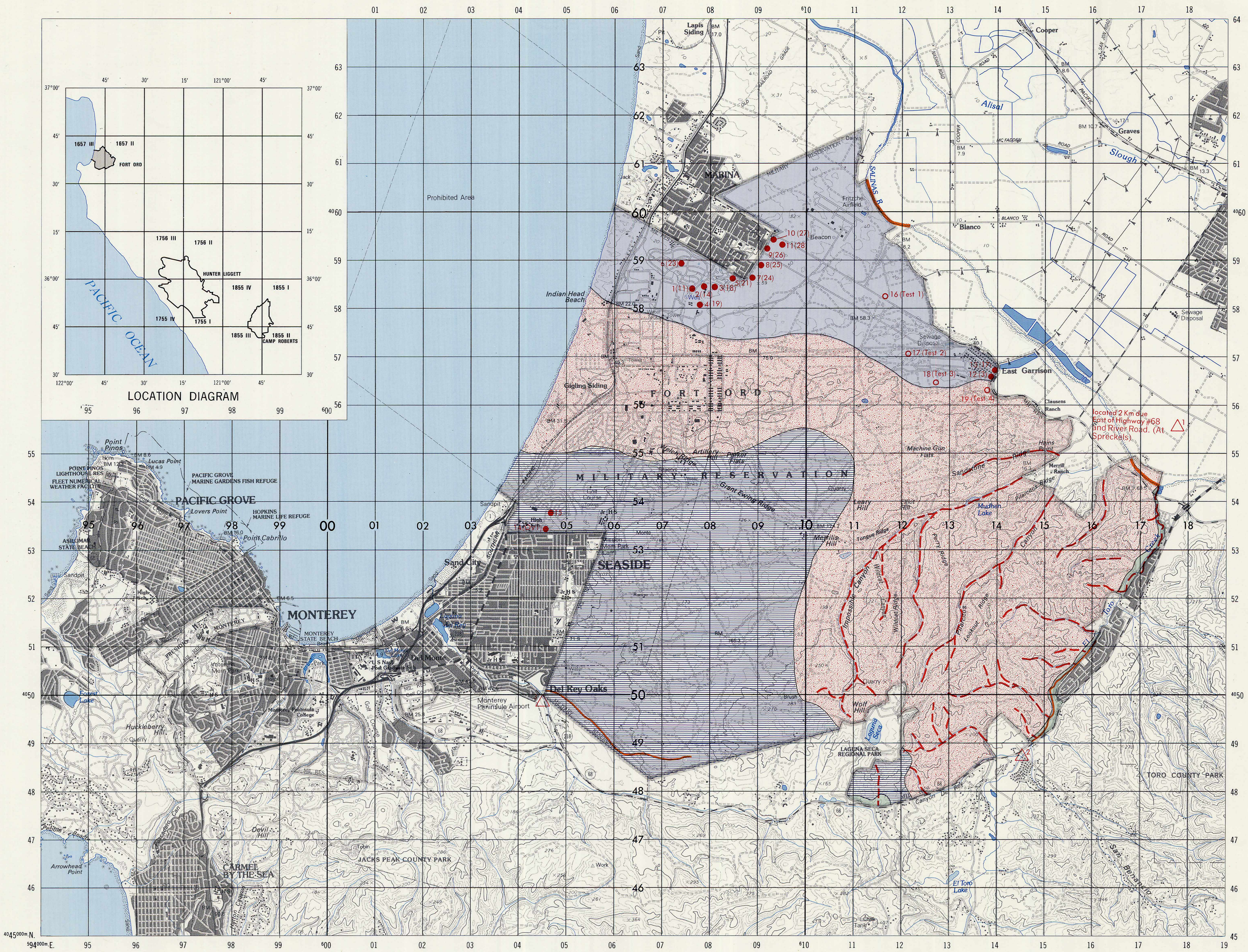
WATER QUALITY, FORT ORD, CALIFORNIA

CONSTITUENT	UNIT OF MEASURE*	WELL NUMBER AND DATE OF SAMPLE** 1(11)	2(14)	3(18)	4(19)	5(21)	6(23)
		May 76	May 76	May 76	May 76	Oct 74	May 76
Alkalinity (as CAC03)	mg/1	82.60	109.00	94.70	159.00	64.00	190.00
pH		7.27	7.32	7.50	7.40	7.50	7.12
Hardness (total as CAC03)	mg/1	144.00	163.00	219.00	243.00	173.00	205.00
Calcium	mg/1	29.80	35.00	49.40	51.30	42.00	42.00
Potassium	mg/1	3.20	3.10	3.50	3.60	2.60	3.40
Silica	mg/1	39.40	79.20	38.40	39.60	38.00	41.00
Specific conductance	μmhos	585.00	603.00	760.00	686.00	563.00	686.00
Total dissolved solid	mg/1	362.00	359.00	443.00	437.00	355.00	406.00
Langlier index (corrosive)		–1.01525	–0.77416	–0.52656	–0.38372	–0.745	–0.907
Color		<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Fluorides	mg/1	<0.10	<0.10	0.11	0.17	0.19	<0.10
Iron	mg/1	<0.10	<0.10	<0.10	<0.10	0.03	<0.10
Magnesium	mg/1	16.50	16.30	22.60	27.10	16.80	21.00
Manganese	mg/1	<0.03	<0.03	<0.03	<0.03	<0.01	<0.03
Chlorides	mg/1	77.70	82.2	135.00	50.10	84.60	80.00
Sulfates	mg/1	71.50	43.3	37.00	100.00	37.00	80.50
Arsenic	mg/1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	mg/1	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Boron	mg/1	0.16	0.20	0.170	<0.10	<0.10	0.16
Cadmium	mg/1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	mg/1	<0.025	<0.025	<0.025	<0.025	0.01	<0.025
Copper	mg/1	<0.025	<0.025	<0.025	<0.025	0.01	<0.025
Lead	mg/1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	mg/1	<0.0004	<0.0004	<0.0004	<0.0004	0.0006	<0.004
Nitrate (as nitrogen)	mg/1	3.60	3.16	4.75	0.15	10.30	2.42
Silver	mg/1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	mg/1	56.50	55.00	53.40	44.40	40.00	52.50
Zinc	mg/1	<0.015	0.03	0.022	0.022	<0.01	<0.015
Gross Alpha	PC/1	<5.00	2.00	<0.50	5.10	<1.10	1.40
Gross Beta	PC/1	3.00	3.20	2.90	3.70	2.90	2.90
Tritium	micro curie/1	0.0005	0.0004	0.0004	0.0005	0.0012	0.0007

CONSTITUENT	7(24)	9(26)	10(27)	11(28)	12(3)	13(17)
	May 76	May 76	Oct 74	May 76	May 76	Oct 74
Alkalinity (as CAC03)	123.08	88.40	136.00	55.00	159.00	204.00
pH	7.50	7.42	7.60	7.29	7.61	7.60
Hardness (total as CAC03)	625.00	144.00	192.00	94.00	201.00	264.00
Calcium	77.00	32.90	52.00	19.70	50.50	67.00
Potassium	5.50	2.60	2.60	2.10	3.30	3.20
Silica	56.40	37.60	40.50	34.80	42.20	42.00
Specific conductance	905.00	482.00	519.00	402.00	608.00	694.00
Total dissolved solid	611.00	289.00	332.00	241.00	388.00	471.00
Langlier index (corrosive)	–0.25697	–0.77254	–0.219	–1.3166	–0.16647	0.032
Color	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Fluorides	0.212	0.18	0.22	0.11	0.30	0.15
Iron	<0.10	<0.10	0.01	<0.10	0.49	0.07
Magnesium	30.30	12.50	15.60	9.10	17.60	22.00
Manganese	<0.03	<0.03	<0.01	<0.03	0.24	0.35
Chlorides	160.00	57.00	33.30	56.70	40.10	33.50
Sulfates	76.50	38.50	86.00	18.30	74.50	109.00
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	<0.30	<0.30	<0.60	<0.30	<0.30	<0.30
Boron	0.20	0.12	0.11	0.11	0.15	0.15
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001
Chromium	<0.025	<0.025	0.10	<0.025	<0.025	0.01
Copper	<0.025	<0.025	0.01	<0.025	<0.025	0.01
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	<0.0004	<0.004	0.006	<0.004	<0.0004	0.002
Nitrate (as nitrogen)	1.26	2.75	0.79	3.05	<0.04	<0.04
Silver	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Sodium	50.10	38.80	34.00	38.00	46.90	48.00
Zinc	0.025	<0.015	<0.01	<0.015	0.031	0.01
Gross Alpha	<0.50	<0.50	<0.60	<0.50	3.60	<0.60
Gross Beta	–0.40	1.90	3.40	2.70	4.70	5.40
Tritium	0.0004	0.0005	<0.10	0.0004	0.0005	<0.10

* mg/1 = milligrams per liter; u mhos = micromhos; PC/1 = Pico Curies per liter.

** Data not available for wells 8(25), 14(OV1), 15(Golf Course).



FORT ORD, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

WATER RESOURCES

SURFACE WATER

FRESH WATER SEASONALLY PLENTIFUL

1. Enormous* quantities available all year from the Salinas River.
2. Very large to large quantities available from December through April. Moderate quantities available May through November.

FRESH WATER SCARCE

3. Small to meager quantities available during dry season from small tributary streams generally less than 0.5 km (0.3 mi) apart, frequently dry; may be continuous small trickle during the wetter season from December to April; only representative streams mapped.

U.S. Geological Survey Gauge Station

GROUND WATER

FRESH WATER GENERALLY PLENTIFUL

1. Very large* quantities from thick sand and gravel of the Salinas Valley pressure aquifers.
2. Moderate to small quantities from varying thicknesses of clastic deposits.

FRESH WATER LOCALLY PLENTIFUL

3. Small to meager quantities from shallow alluvium.

FRESH WATER SCARCE OR LACKING

4. Small to meager quantities from isolated deep lenses of sand and gravel.

1 (11) Production Well (number in parentheses is Fort Ord designator)

16 (Test 4) Test Well

NOTE: Number refers to entry in table.

*Definitions of underlined terms are as follows:

	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Enormous	>40,000	>15,000,000
Very large	4,000–40,000	1,500,000–15,000,000
Large	400–4,000	150,000–1,500,000
Moderate	40–400	15,000–150,000
Small	4–40	1,500–15,000
Meager	<4	<1,500

USER NOTE: For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM 5-700, July 1967 Paragraph 19, or other applicable manuals or regulations.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

D. ENGINEERING SOILS

SOIL CHARACTERISTICS AND SELECTED EVALUATIONS

This table and the accompanying soils map are generalized, but the information is considered to be fairly reliable for general planning and for an understanding of some of the basic conditions of the area. It is intended as a guide, but not to supplement, detailed investigations of sites for specific uses.

The map is based primarily on an interim report, entitled, Soil Survey of Monterey County, California, prepared by the Soil Conservation Service, U.S. Department of Agriculture, April 1975.

The soils of Fort Ord cover the entire spectrum in terms of constituents; the predominant characteristic is the abundance of sand. Roughly the western half of the reservation is covered with stabilized Pleistocene sand dunes (Map Unit 3) or sand from old terrace deposits (Map Unit 7). Consequently, the soils in this area are sandy to great depths. The remainder of the reservation contains soils developed on sandy, gravelly alluvial and terrace parent materials. Here again, coarse-textured soils predominate.

Fine-grained materials such as silty and clayey soils are very limited in extent. They occur in depressions, valleys, on some of the sedimentary rocks in the eastern part of the reservation, and along the Salinas River flood plain.

In terms of engineering, most of the reservation consists of soils which have severe to moderate limitations for construction purposes. Most of the area is unsuitable for disposal of liquid wastes due to the high porosity and permeability of the soils or the shallow depth to rock. The porous nature of the soil would also result in excessive leakage around dams and reservoirs.

Most soils are suitable for road surfaces and for use as fill material although limited amounts of clays, silts or plastic materials present on the base may have a detrimental affect on its use for these purposes.

For more comprehensive information concerning kinds, distribution and properties of Fort Ord soils, the user of this terrain study should seek the assistance of the Soil Conservation Service, U.S. Department of Agriculture, Paso Robles, California.

MAP UNIT	MAJOR SOIL SERIES 1/	GEOGRAPHIC SETTING	TYPICAL SOIL PROFILE — layers, thickness and color of layers, depth to rock, and Unified engineering classification 2/(Profile diagram not to scale).	HIGH-WATER TABLE-depth (meters) and duration (months)	PERMEABILITY-centimeters/hour or (inches/hour)	SHRINK-SWELL POTENTIAL	RATING AND MAJOR KINDS OF LIMITATIONS FOR: SEWAGE LAGOONS	SEPTIC TANK FILTER FIELDS	FOUNDATIONS FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATIONS	TRAFFICABILITY	BIVOUAC SITES	REMARKS
1		Smooth, wave-worked coastal beach. Mostly covered by waves at high tide. Most slopes between 2 and 5 percent; locally up to 10 percent.	cm SP, GP: Wave-worked material; predominately sand or a mixture of sand and gravel; in places cobbles and boulders. 180+	Flooded at high tide.	Greater than 50 cm/hr (Greater than 20.0 in/hr)	Low	NOT APPLICABLE. COVERED WITH WATER AT HIGH TIDE.							In some places beach erosion is taking place. Beach very narrow in places. Map unit comprises about 1.1 km^2 (272 acres).
2		Gently sloping to steep hummocks, mounds, and hills of loose wind-deposited sand (sand dunes). Elevations 20 to 300 feet. Dunes mostly stabilized with coastal or inland vegetation. Slopes 20 to 50 percent.	cm SP: Dominantly yellowish-white quartz-feldspar coarse to fine sand. Sands are loose throughout depth. 180+	Varies with thickness of dunes; commonly greater than 1 m at base of dunes.	5.0 to 15.0 cm/hr (2.0 to 6.0 in/hr)	Low	Moderate (u) (p)	Severe (u)	Severe (u)	Severe (u)	Severe (u)	Severe (u)	Severe (u)	Locally subject to severe wind erosion resulting in dune movement and "blow out pockets". Area should be avoided for wheeled vehicular traffic. Map unit comprises about 2.7 km^2 (655 acres).
3	Oceano	Low, rolling hills; soils formed from old stabilized dunes. Slopes dominantly 2 to 15 percent; some greater than 20 percent.	cm SP, SM: Grayish-brown sandy loam to fine sandy loam. 50 SM: Predominantly brown to light yellowish-brown loamy sand over unconsolidated sand. 180+	None	5.0 to 15.0 cm/hr (2.0 to 6.0 in/hr)	Low	Severe (s) (r) (p)	Severe (r)	Severe (s)	Moderate (s)	Severe (u)	Slight	Slight	Best unit for movement, construction, and the stationing of forces. Map unit comprises about 88.3 km^2 (21,838 acres).
4		Severely eroded uplands broken by numerous entrenched drainage channels (badlands). Soils derived from soft unconsolidated sediments. Most slopes greater than 35 percent; typically 50 to 65 percent.	cm GC, SP, SC: Unconsolidated or weakly consolidated alluvium. Mostly sandy loam or coarse sandy loam with gravel and cobbles; commonly stratified. 180+	None	Greater than 50.0 cm/hr (Greater than 20.0 in/hr)	Low	Severe (s) (p)	Severe (s)	Severe (s)	Severe (s)	Severe (s)	Severe (s)	Severe (s) (u)	Subject to severe water erosion during rains; potential hazard of deposition on adjacent roads and lands. Map unit comprises about 16.8 km^2 (4111 acres).
5		Predominantly rock outcrops on steeply sloping uplands and valleys sides. Slopes typically 30 to 50 percent.	cm Bed rock: Rock outcrop over most of the area. Slightly indurated conglomerate, sandstone, and marl. Very thin sandy loam with rock fragments and gravel in some places. 180+	None	5.0 to 15.0 cm/hr) (2.0 to 6.0 in/hr)	Low	Severe (s) (r)	Severe (s) (r)	Slight	Severe (s) (r)	Severe (s) (r)	Severe (s)	Severe (s) (r)	Rock outcrops; thin soil cover in places. Fairly hard rock where cemented. Map unit covers about 0.4 km^2 (110 acres).
6	Dibble	Highly dissected uplands including some steeply sloping valley sides. Most slopes between 30 to 50 percent.	cm CL: Pale brown silt loam and clay loam. 20 CL: Pale brown and light yellowish-brown clay loam; plastic. 76 Bed rock: Bedrock consisting of hard, brown, weathered shale. 180+	None	1.5 to 5.0 cm/hr (0.6 to 2.0 in/hr)	High	Severe (s)	Severe (s)	Severe (s) (u) (x)	Severe (s) (u) (x)	Severe (s) (u)	Severe (s) (u)	Severe (s)	Rapid runoff. Erosion hazard high. Map unit comprises about 2.1 km^2 (525 acres).
7	Arnold Santa Ynex Elkhorn	Undulating to steeply sloping uplands formed on old terrace deposits. Slopes 2 to 50 percent; typically, 15 to 30 percent.	cm SM: Gray to dark brown fine loamy sand to fine sandy loam. 45 ML, SC: Gray to dark brown fine sandy loam to sandy clay loam. 110 SM, CH: Mixed brown to gray, non-plastic to moderately plastic, loamy sand to clay loam. 180+	None	5.0 to 15.0 cm/hr (2.0 to 6.0 in/hr) to 0.5 to 1.5 cm/hr (0.2 to 0.6 in/hr)	Low to High	Severe (s)	Severe (s)	Severe (s) (x) (c)	Severe (s) (x) (c)	Severe (s)	Moderate (s) (u) (c)	Moderate (s)	Santa Inez has high clay content in subsoil. Some areas contain many small rocks at surface. Map unit comprises about 2.1 km^2 (525 acres).
8		Small flood plains in narrow stream valleys. Slopes 2 to 5 percent.	cm SM: Yellowish-brown loamy sand. 38 ML: Brown to dark grayish-brown sandy silt loam. 102 MH: Brown to grayish clay loam. 127 CL: Grayish clay loam. Bed rock: Various type bedrock, such as conglomerate, sandstone, shale, or marl. 180+	1.5 to 2.0 m (5 to 7 ft.)	5.0 to 15.0 cm/hr (2.0 to 6.0 in/hr)	Low to High	Severe (v) (w)	Severe (v)	Severe (v)	Severe (v)	Severe (v)	Slight (dry) Severe (wet) (w)	Severe (v)	Clay content of subsoil varied, dependent on landform and slope. Map unit comprises about 0.7 km^2 (175 acres).

1/ Soils that have profiles almost alike make up a soil series. The series is the common name of the soil. Each series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Many other minor soils are included in the map unit. Soil series are not identified for some map units.

2/ The Unified Soil Classification System, Technical Memorandum No. 3-357, U.S. Army Corps of Engineers, March 1953.

DEFINITIONS OF RATING TERMS

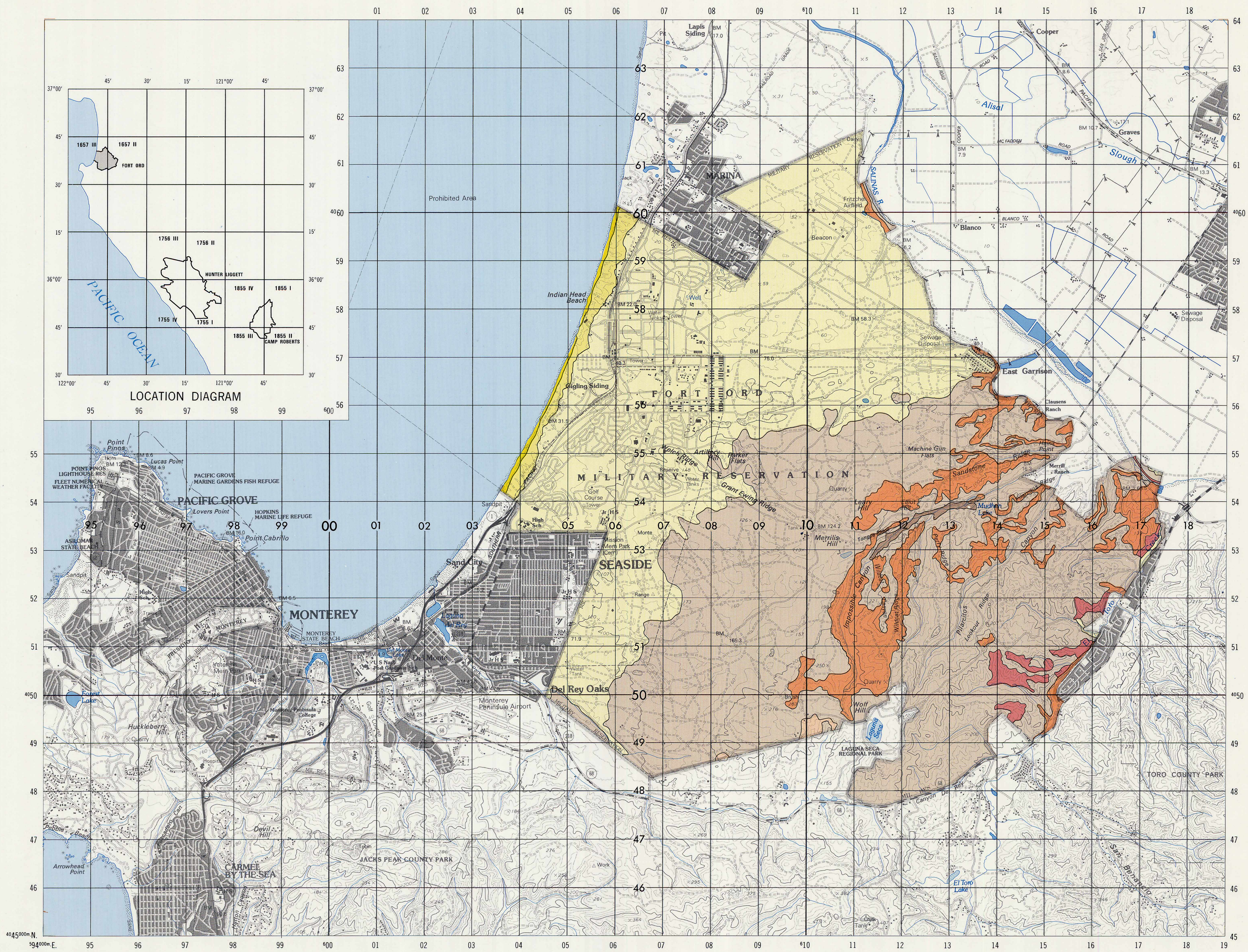
SLIGHT – relatively free of limitations or limitations are easily overcome.

MODERATE – limitations can be overcome with good planning and/or careful design.

SEVERE – limitations are serious and are difficult to overcome.

SOIL CHARACTERISTICS AFFECTING LIMITATIONS

c – clayey subsoil	u – unstable soils
p – rapid permeability	v – high flood potential
r – rock	w – wetness
s – slope	x – high shrink-swell potential



FORT ORD, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

ENGINEERING SOILS

COARSE-GRAINED SOILS

1 Beach deposits consisting of poorly graded sand or a mixture of sand and gravel; cobbles or small boulders in some places.

2 Coastal dunes consisting of loose coarse- and fine-grained sand.

3 Deep, well-drained to excessively drained sandy loam and loamy sand over unconsolidated sand; occurs on rolling uplands.

4 Severely eroded uplands consisting of coarse sandy loam and mixed with varied amounts of gravel and cobbles; commonly stratified.

5 Mainly rock outcrops; locally, very thin cover of gravelly or sandy soils containing rock fragments.

FINE-GRAINED SOILS

6 Clayey soils over weathered bedrock; occurs on dissected uplands.

COARSE- AND FINE-GRAINED SOILS

7 Sandy loam over clay loams; occurs mainly on old terrace deposits.

8 Sandy to silty surficial soils overlying loams and clays; inextensive on narrow flood plains.

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

E. ENGINEERING GEOLOGY

Fort Ord, in the California Coast Ranges section of the Pacific Border physiographic province, is at the edge of the Salinas River valley, which is the site of a relict valley filled with hundreds of feet of Tertiary and Quaternary marine and none-marine clastic sediments deposited on a basement rock of Mesozoic granodiorite. Elevations on the reservation range from sea level at the west to nearly 274 meters (900 ft) in the hills of the east-central part of the Fort.

The predominant surficial material is sand. The western half of the reservation is composed of beach sand, recent sand dunes, and a large area of stabilized Pleistocene dunes. The eastern half is composed of sandstone, alluvial materials, conglomerate, and a small outcrop of diatomite.

The evaluation of geologic materials reveals a rather limited utility for engineering purposes. Surface materials, in general, will support moderate to heavy structures on natural foundations, except on steep slopes and in the limited areas of clay. Roads and railroads require some curving alinements and moderate cut-and-fill. High porosity and permeability make disposal of large quantities of both liquid and solid wastes inadvisable because of the probability of contamination of groundwater.

Surface materials on Fort Ord can provide abundant quantities of some construction materials; presently, however, all needs are satisfied by purchase from off-base sources. Good quality quartz and feldspar sand is easily obtainable from beach deposits and recent dunes. Gravel is relatively abundant in alluvial and terrace deposits. The diatomite outcrop is a potential source of material useful for limited purposes.

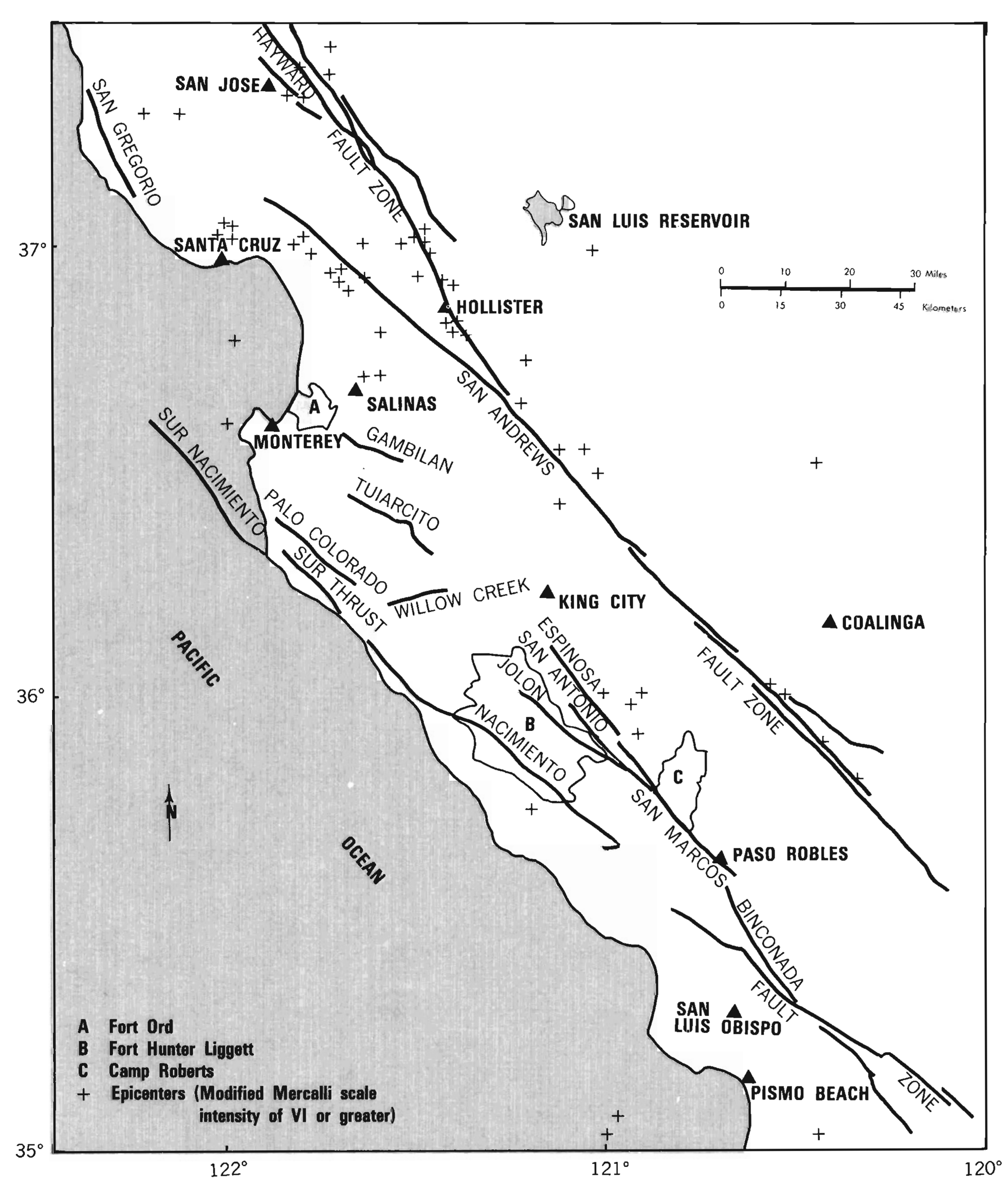
Fort Ord is in a region of active faulting and earthquake activity. See Section F, Special Physical Phenomena for further discussion.

Geological units on the accompanying map were delineated from aerial photo analysis and from U.S. Geological Survey maps. Unit boundaries are not precise.

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
1. Sand, Pleistocene stabilized dunes	Extensive area of gently sloping to rolling dunes with numerous small interdunal depressions. Elevations range from a few meters above sea level near the beach to more than 244 m (800 ft) inland. Established drainageways virtually nonexistent.	Fine-grained, moderately weathered sand, slightly cemented with clay in places, as thick as 200 m (656 ft); blanketed with poorly developed brown to yellow-brown sandy soil 50 to 180 cm (20 to 71 in) thick. Unconsolidated fluvial and eolian deposit.	No data.	Extensive areas available for military construction and maneuver. Bearing capacity adequate for moderate to heavy structures, except on infrequent steep slopes. Relatively unweathered sand good for surface course of light-duty roads; durable and skid-resistant. Weathered sand unsuited for most construction uses; soil and weathered sand, however, suited for fill. Unsuited for disposal of liquid and solid wastes because high permeability may permit contamination of ground water.	Overburden thin and loose. Unit easily excavated with draglines or front loaders. Excavations will require shoring; drainage is good.	Borrow pit sites abundant throughout unit. Access easy from existing roads.
2. Alluvial sand; some gravel and minor shale	Thin deposits of alluvial materials on flood plains and in valley bottoms and small depressions; and small areas of thicker flood plain and alluvial terrace materials along the Salinas River.	Irregularly stratified deposits of alluvial sand, silt, clay and gravel. Sand predominates; some gravel locally in lenses. Materials along the Salinas River are derived from granitic and Tertiary sedimentary rocks, and include some clay shale and opaline shale.	Generally high porosity and permeability. Hardness and strength of weathered sand and gravel diminished from original values.	Unit limited in area on uplands, and narrow along drainageways. Bearing capacity variable. Limited amount of material available for engineering use, particularly as subbase for roads and as fill. Sand and gravel generally unsuited as Portland cement aggregate because of deleterious chemical reactivity. Valley alluvium is a potential source of better quality sand and gravel.	Excavation relatively easy with power equipment. Overburden thin to absent. Deeper excavations require shoring; dewatering necessary in drainageways seasonally.	Small borrow pit sites available at many places. Access easy along existing roads, but narrow valleys limit access in places. Only a small portion of the alluvial materials along the Salinas River are within the Fort Ord boundary.
3. Sandstone	Extensive area of rolling terrain at higher elevations in central part of Fort Ord. Coarsely dissected where steeper slopes predominate; essentially undissected in areas of less steep slopes. Also caps some small relief features in Unit 2, and includes some outcrops on valley sides in eastern part of area.	Predominantly reddish to yellowish-brown massive to fine-grained sandstone with some gravel, in places slightly cemented with clay or iron oxide. Includes limited areas of soft sandstone with interbedded diatomaceous earth, conglomerate, and pumice.	No data.	Areas available for multi-structures emplacement or roads with easy alinements limited to less dissected terrain. Bearing capacity adequate for moderate to heavy structures on natural foundations. Large amount of material available for road subbase and for fill; limited amount of good aggregate from selected localities.	Overburden relatively thin. Excavation easy with power equipment. Access easy from existing roads.	Abundant potential quarry sites available in exposures adjacent to roads. Steep sides of excavations require support.
4. Sand, beach and recent dunes	Narrow sandy beach paralleled inshore by narrow belt of recent dunes. Dunes are gently sloping to steep hummocks, closely spaced mounds, and hillocks.	Well sorted, sub-angular to sub-rounded, fine- to medium-grained quartz and feldspar sand.	Grain size 0.1 to 2.0 mm. Permeability high. Specific gravity 2.55 to 2.59.	Narrow width and unstable materials limit usefulness. Dunes can provide abundant supply of well sorted quartz and feldspar sand suitable for concrete and bituminous aggregate and for specialty sands. Best quality and coarser sand occurs in the southern part of the unit. Unsuited for disposal of liquid and solid wastes because high permeability may permit contamination of ground water and near-shore sea water.	Little to no overburden. Unit easily excavated with draglines or front loaders. Excavations will require shoring, and dewatering if below sea level.	Borrow pit sites abundant throughout unit. Access easy from existing roads.
5. Conglomerate; lenses of sandy and marly clay	Large area of hillocky terrain in southeastern part of Fort Ord, and outcrops along stream valleys. Coarsely dissected with dendritic drainage pattern. Includes areas of steepest slopes on Fort Ord.	Slightly to poorly consolidated conglomerate with lenses of sandy and marly clay; weakly cemented with silica and clay. Consists of an irregular deposit of older alluvial fan, lacustrine, and flood plain materials.	No data.	Unsuited for many engineering purposes because of lack of level or near-level terrain. Road alinements require many curves, grades, cut-and-fill, and some small bridges. Access to construction sites relatively easy from existing roads. Bearing capacity adequate for moderate to heavy structures, roads, and airfields, except on steeper, clayey slopes. Abundant material available for fill; limited sand and gravel available from probable small lenses, but will require washing and screening.	Overburden generally relatively thin, but thicker locally. Excavation easy with power equipment. Access generally easy from existing roads. Excavations stable except where loose sand predominates.	Abundant potential borrow pit sites available, with access from existing roads. Use of material probably negligible because other material from nearby sources occurs in larger amounts and requires less processing.
6. Diatomite	Small outcrop on sides of stream valley in southeastern Fort Ord.	Approximately 15 m (50 ft) thickness of yellowish-white, massive, slightly to strongly indurated diatomite overlying the Monterey Shale formation. Predominantly silica with varying amounts of impurities. A marine sedimentary deposit.	No data.	Material is exposed over a very small area and is useful only as insulation, filter, building blocks, or a filler in dynamite. Testing and evaluation required to determine quality and quantity; similar deposits outside Fort Ord have been uneconomical.	Excavation requires power equipment, and blasting or other mining techniques. Difficulty of removal depends upon degree of cementation. Overburden as thick as 30 m (98 ft).	Only one presently known site available; approximately 1000 m (0.6 mi) from hard-surface road, requiring construction of access road.

F. SPECIAL PHYSICAL PHENOMENA

MAJOR FAULTS AND APPROXIMATE EPICENTERS OF EARTHQUAKES OF CENTRAL COASTAL CALIFORNIA THROUGH 1970



Earthquakes. Fort Ord is in a seismically active environment midway between two large active fault zones which trend northwesterly — the San Andreas zone northeast of the reservation and the Sur-Nacimiento to the southwest.

Two smaller fault zones, the Gambilan (an extension of the King City zone) at Fort Ord, and the Tularcitos which borders the reservation on the southwest, are considered not to have been active on land in recent geologic history. There is no evidence that near-surface bedrock (the Paso Robles Formation) has been faulted as has the underlying Monterey Formation. Extensions of these zones offshore, however, appear to be presently active, and faulting at depth is a potential source of earthquakes.

The magnitudes of most earthquakes in this area have not been large and damage has been slight. The accompanying table indicates the number of earthquakes in the Monterey Bay area from 1926 to 1972, their frequency, the magnitudes of resulting quakes, and the approximate location of epicenters. The city of Salinas, near Fort Ord, sustained damage from one of the larger quakes.

Based on the location of active faults and the seismic history, it appears certain that the area will continue to be subject to earthquakes, and that there will always be a potential for quakes of sufficient magnitude to cause significant damage to facilities at Fort Ord. The area is in Zone 3 of the Seismic Risk Zone map of the U.S. Geological Survey (possible major damage). Although Fort Ord is in the highest-risk zone, the Seismic history and geology indicate that the risk should be less than Zone 3 near active faults.

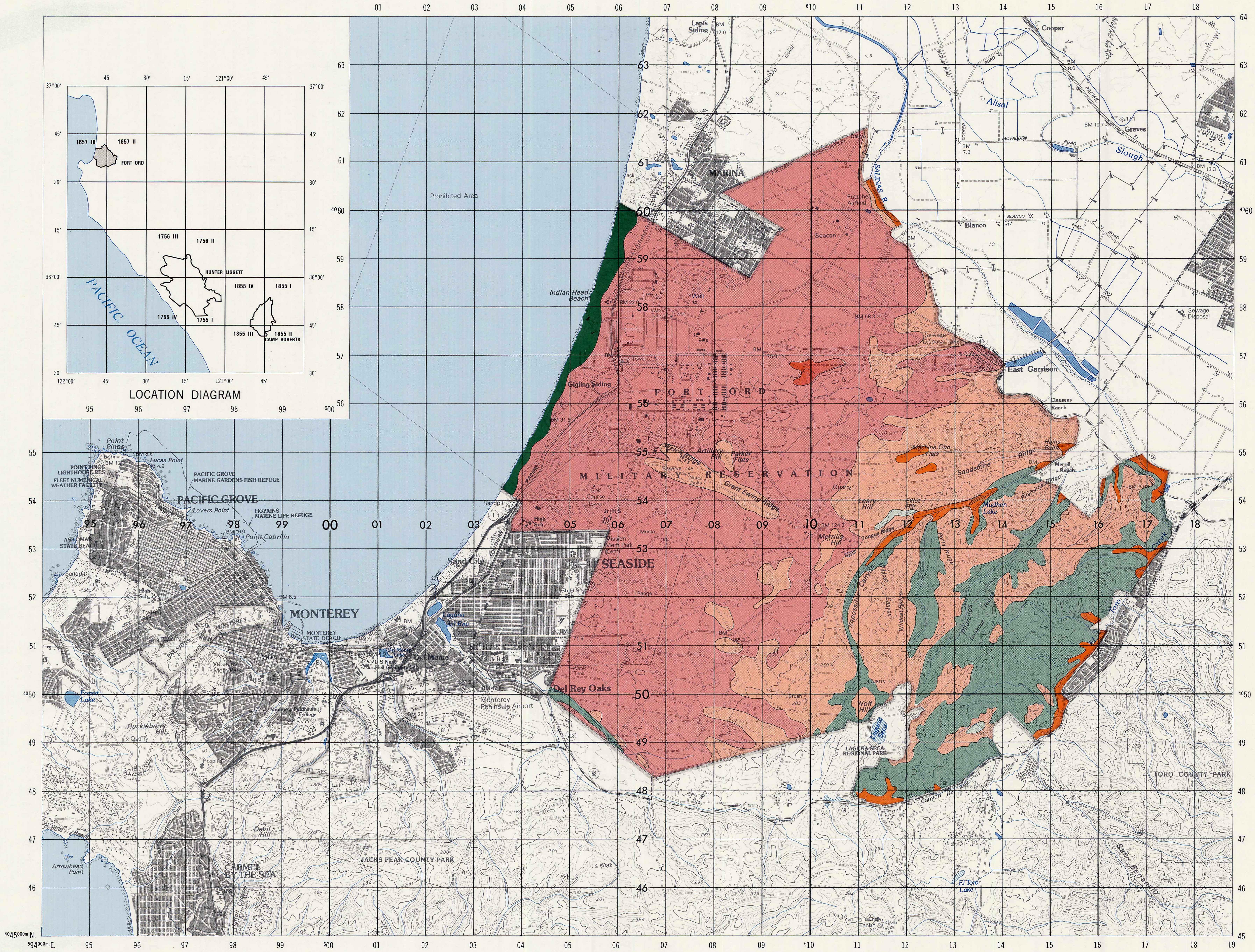
Tsunamis. There is a minor potential for the occurrence of tsunamis ("tidal waves") in Monterey Bay. Two tsunamis have been recorded, with wave heights of 1.5 m (5 ft) and 1.8 m (6 ft); slight damage occurred in the northern part of the bay in the vicinity of Moss Landing. Tsunamis of these magnitudes do not pose threats to property at Fort Ord; those of greater magnitude, however, could cause some damage to any coastal installations.

MAJOR FAULTS AND APPROXIMATE EPICENTERS OF EARTHQUAKES OF CENTRAL COASTAL CALIFORNIA THROUGH 1970

(Intensity of VI or Greater on Modified Mercalli Scale*)

YEAR	DATE	N. LAT	W. LONG	INTENSITY
1970	Jan. 2	37°18′	122°6′	VI
1969	Oct. 27	36°48′	121°24′	VI
1967	Dec. 18	37°0′	121°48′	VI
	Sept. 28	37°12′	121°36′	VI
	Sept. 7	37°0′	121°48′	VI
	July 22	36°30′	121°6′	VI
1966	Oct. 14	37°0′	121°48′	VI
	June 27	35°54′	120°54′	VII
1963	Sept. 14	36°48′	121°36′	VII
	May 22	37°18′	122°12′	VI
1961	Apr. 8	36°42′	121°18′	VII
1960	Jan. 19	36°48′	121°24′	VI
1959	Dec. 28	36°54′	121°30′	VI
	May 26	36°42′	121°36′	VI
	Mar. 2	37°0′	121°36′	VI
1958	Sept. 30	36°24′	121°6′	VI
1956	Nov. 15	36°0′	120°30′	VI
1955	Nov. 2	36°0′	120°54′	VI
	Sept. 4	37°24′	121°48′	VII
	Mar. 2	36°0′	120°54′	VI
1954	Sept. 15	37°18′	120°0′	VI
	Aug. 12	36°54′	121°42′	VI
	Aug. 22	36°54′	121°42′	VIII
	Mar. 19	36°54′	121°42′	VI
1953	Dec. 16	36°54′	121°42′	VI
1952	Nov. 21	35°48′	121°12′	VII
1951	Oct. 31	36°54′	121°24′	VI
	Aug. 6	36°36′	121°12′	VI
	July 29	36°36′	121°12′	VI
1949	June 9	37°24′	121°36′	VI
	Mar. 9	37°0′	121°30′	VII
1948	Dec. 31	36°54′	121°36′	VII
1947	Aug. 10	36°54′	121°24′	VI
	June 22	37°0′	121°48′	VI
1945	Aug. 27	37°18′	121°48′	VI
	May 17	36°48′	121°24′	VI
	Jan. 7	36°42′	121°12′	VI
1943	Oct. 25	37°24′	121°42′	VI
1939	June 24	36°48′	121°24′	VII
1934	June 7	36°0′	120°30′	VIII
1927	Nov. 18	35°0′	120°30′	VI
	May 28	37°18′	121°48′	VI
	Feb. 15	37°0′	122°0′	VI
1926	Oct. 22	36°45′	122°0′	VIII
	July 25	36°30′	120°30′	VI
1924	Dec. 27	36°42′	121°36′	VI
1922	Mar. 10	35°45′	120°15′	IX
1916	Dec. 1	35°0′	121°0′	VII
	Aug. 6	36°30′	121°0′	VII
1914	Nov. 8	37°0′	122°0′	VII
1911	July 1	37°0′	122°0′	VII – VIII
	Mar. 11	37°0′	121°0′	VI
1901	Mar. 2	36°0′	120°30′	VII – VIII
1899	Apr. 30	37°0′	121°30′	VII
1897	June 20	37°0′	121°30′	VIII
1892	Nov. 13	36°30′	122°0′	VI
1890	Apr. 24	37°0′	121°30′	VII
1885	Apr. 11	36°0′	121°0′	VII – VIII
	Mar. 30	36°30′	121°0′	VII
1883	Mar. 30	37°0′	122°0′	VI
1865	Oct. 8	37°0′	122°0′	VIII – IX
1852	Dec. 17	35°0′	121°0′	VII – VIII

*Note: Intensity of VI indicates lowest level of damage.
Intensity of IV indicates collapse of some structures.



FORT ORD, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

ENGINEERING GEOLOGY

MANY ENGINEERING USES

1. Sand, Pleistocene stabilized dunes.

SOME ENGINEERING USES

2. Alluvial sand; some gravel and minor shale.
3. Sandstone.

FEW ENGINEERING USES

4. Sand, beach and recent dunes.
5. Conglomerate; lenses of sandy and marly clay.
6. Diatomite.

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

G. VEGETATION

Fort Ord has three major types of vegetative cover: forests, grasslands, and mixed scrub. The location and extent of the three types are shown on the accompanying map. Details concerning each, including assessments of cover and concealment, are given in the table below. All three types of vegetation are significant in relation to military maneuvers and other training activities. In combination, they virtually cover approximately 90% of the Fort Ord area. Sand dunes and open (Cantonments) lands are relatively insignificant in area coverage.

Forests:

Forest cover is predominantly deciduous, almost exclusively California live oak. Other forest species found include willow, black cottonwood, Monterey cypress, California sycamore along the watercourses, and dwarf blue gum planted along the coastal and/or built-up areas. Undergrowth varies from an open grassland to dense areas of bracken fern, poison oak, blackberries, and other various forms of leafy vegetation and brush.

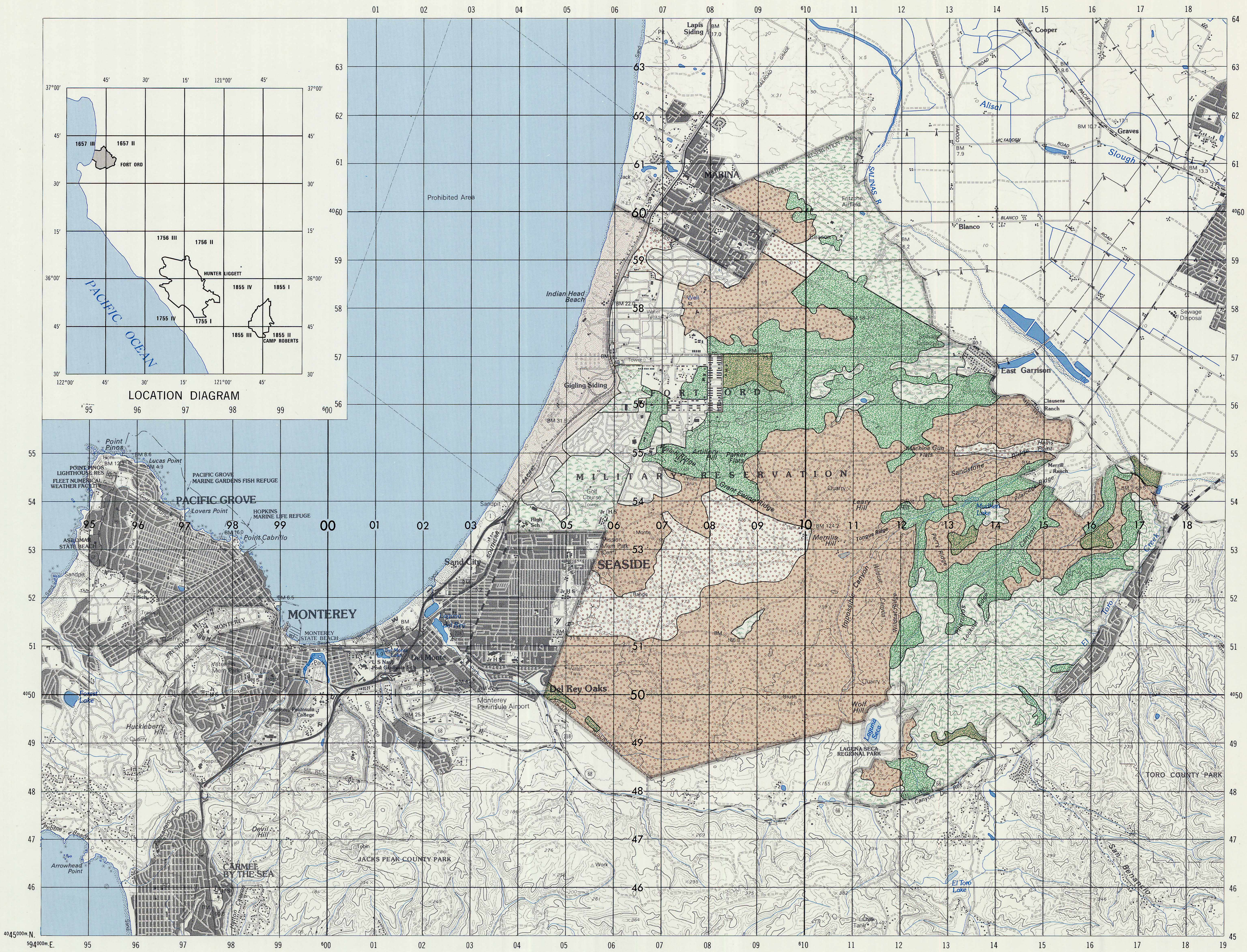
Grasslands:

Predominantly short grasses, grass species include wild oats, foxtail, ryegrass, and forbs such as filaree and burr clover. Purple needlegrass, a native bunchgrass, is also found in these areas along with many varieties of spring wildflowers. Scattered trees, not exceeding 10% crown cover density, exist.

Scrub:

Mixed deciduous and coniferous scrub covers approximately 35 to 45% of the Fort Ord area. Scrub species include manzanita, chaparral, chamise, coyote brush, and California sagebrush. Existing areas are principally confined to the impact areas.

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
1	Deciduous trees; 50 to 100% crown cover density; dominant trees include California live oak, willow, black cottonwood, California sycamore, and occasionally box elder and California Buckeye; most of the trees are small but a few, such as the cottonwood and sycamore, attain heights of 12 to 15 m (40 to 50 ft); trees closely spaced, 1 to 4 m (3 to 12 ft) apart; diameters of trunks vary considerably; undergrowth usually quite dense consisting of ferns, blackberries, curronts, miner's lettuce, and other forms of leafy vegetation and brush; 75% or more of each stand composed of one or more deciduous species.	Map unit covers only a very small portion of Fort Ord; found along the Salinas River and in steep shady canyons and on north facing slopes; in general this type will follow watercourses.	There is no merchantible timber within the area.	Cover for foot troops from flat-trajectory fire of small arms is fair depending mainly on trunk diameters.	Concealment from aerial and ground observation is good for foot troops and vehicles during spring and summer months and fair the rest of the year.
2	Deciduous trees; 10 to 50% crown cover density; dominant species is California live oak; up to 8 m (26 ft) in height; multi-stemmed and can be found in clusters or randomly scattered throughout the area; trees generally widely spaced; trunk diameters vary up to 25 cm (10 in); undergrowth fairly open consisting mainly of grasses; where undergrowth does occur, poison oak and bracken fern are the most dominant types; 75% or more of each stand composed of one or more deciduous species.	Covers approximately 25 to 35% of the fort; most areas located on the northern half.	There is no merchantible timber within the area; no leafless period.	Cover for foot troops from flat-trajectory fire of small arms is poor.	Concealment from aerial observation is fair for foot troops and poor for vehicles year round; concealment from ground observation is largely poor for foot troops and vehicles.
3	Mixed deciduous and coniferous scrub; 50 to 100% canopy closure*; species include various varieties of manzanita, chaparral, chamise, toyon, coyote brush and California sagebrush; up to 1.1 m (4 ft) in height; scattered clumps of multi-stemmed live oaks up to 8 m (26 ft) high throughout the area; roughly equal distribution of deciduous and coniferous species. *Canopy closure is used for scrub, since true crowns are lacking on this low growing scrub.	Along with Map Unit 4 this unit covers 35 to 45% of the Fort Ord area; primarily located in the impact areas in the southwest.	Controlled burning to reduce fire hazards and improve wildlife habitats are an integral part in the land management program; extremely dense brush, almost impenetrable for movement by foot troops and most vehicles.	Cover for foot troops from flat-trajectory fire of small arms is poor.	Concealment from aerial and ground observation is poor for both foot troops and vehicles; limited concealment for foot troops in prone position.
4	Mixed deciduous and coniferous scrub; 10 to 50% canopy closure (see Map Unit 3); scrub and plants include manzanita, coyote brush, California sagebrush, chaparral, and toyon; low-growing, open brush up to 0.75 m (2 ft) in height; scattered live oaks can also be found; roughly equal distribution of deciduous and coniferous species.	Along with Map Unit 3 this unit covers 35 to 45% of the fort; primarily located in the impact areas in the southwest.	Controlled burning to reduce fire hazards and improve wildlife habitats are an integral part in the land management program; scrub is often sparse enough to afford limited movement by foot troops and vehicles.	Cover for foot troops from flat-trajectory fire of small arms is poor.	Concealment from aerial and ground observation is poor for both foot troops and vehicles; limited concealment for foot troops in prone position.
5	Short grasses: less than 1 m (3 ft) in height; contains groups of native bunchgrass such as purple needlegrass; spring wildflowers found throughout this area include blue lupines and orange poppies; some scattered trees, not to exceed 10% crown cover density.	Covers approximately 20% of Fort Ord and can be found in two major locations, the extreme northern tip around Fritzsche Airfield and the southeast portion where the hills become higher and the maritime climate has less of an influence on the landscape.	During the long summer dormant season the grasslands protect soil from wind erosion; during the wetter winter months, these grasslands are used for the grazing of sheep and also aid in preventing soil erosion.	No cover for foot troops.	No concealment for foot troops or vehicles.
6	Sand Dunes: this area is known as the Coastal Strand or the "Dunes"; it not only contains sand but a wide variety of coastal type vegetation which includes African ice plant, European beach grass, seaside painted cup, mock heather, coast buckwheat, coast wallflower, coffeeberry, beach morning glory, and poison oak.	Covers only a very small portion of Fort Ord; it is restricted almost entirely to the western side of Route 1 and extends to the water's edge.	The vegetation growing in the "Dunes" plays two very important roles serving as a protective shield against the destructive winds, and in stabilizing the sand dunes; without this cover of vegetation the dunes of sand would continually be on the move and could eventually destroy everything in their paths; ice plant is the major ground cover planted in and around urban areas and on the dunes to help stabilize the sandy soils.	No cover for foot troops.	No concealment for foot troops or vehicles.



FORT ORD, CALIFORNIA TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS

SUPPLEMENTARY CONTOURS 10 METERS

VEGETATION

FORESTS

1 Deciduous trees; medium to dense spacing.

2 Deciduous trees; nearly open to medium spacing.

SCRUB

3 Mixed scrub; medium to dense spacing.

4 Mixed scrub; nearly open to medium spacing.

GRASSLANDS

5 Short grasses.

OTHER

6 Sand dunes.

OPEN

OPEN 7 Built-up areas, barren areas and heavily used areas. Vegetation is not a significant factor.

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

H. CLIMATE

Fort Ord is located on stabilized sand dunes near the mouth of the Salinas Valley. It extends southward between the ocean and the Salinas Valley. The proximity of the ocean tends to give Fort Ord a moderate year-round climate. There is a difference of 8° C (14° F) between the mean temperatures of the warmest and the coldest months, which are September and January, respectively. The record high and low temperatures, over an 11-year period, at Fort Ord are 39.4° C or 103° F and −5.0° C or 23° F. Nearby Salinas, with more than 50 years of records to draw upon, has registered an absolute maximum temperature of 43.3° C or 110° F and an extreme low of −7.8° C or 18° F, and these figures are probably more indicative of extremes that might realistically, given a longer period of time, be expected to occur also at Fort Ord (although this station is near the ocean, and thus its temperature extremes are moderated). Due also to the short period of record, the Fort Ord climatological table below gives an erroneous impression that March is colder than February. In fact, based on the longer records at Salinas as well as at other central coastal California stations, the month of March averages about 1.1° C (2° F) warmer than February.

The Fort Ord summers are dry, with over 90% of the annual precipitation occurring in the November–April half of the year. Rainfall of course varies from year to year, and in the case of nearby Salinas, over a 45-year period, The total annual precipitation has ranged from a low of 145.8 mm (5.74 in) in 1953 to a high of 713.7 mm (28.10 in) in 1940. There are fewer than two thunderstorms a year, on a average. Snowfall is practically unknown, a trace being the greatest amount ever recorded. Hail is nearly as infrequent as thunderstorms.

From March through October the prevailing wind is from the northwest, with speeds averaging 9 to 13 kmph (5 to 7 knots). In late fall the frequency of northwesterly winds decrease, and during December and January the prevailing winds are easterly.

Fog and low stratus clouds moving inland from the ocean are fairly frequent, especially on summer mornings. As a general rule, these fogs and stratus clouds dissipate before noon. Occasional stagnant air during the winter brings some days of heavy fog, but this condition is infrequent and the periods are of short duration. Relative humidity is fairly high, generally averaging from 82% to 93% at 0400 hours and from 57% to 71% at 1300 hours.

The average date of the last freezing temperature in the spring is March 13, and the first frost in the fall is about December 1, giving a normal growing season of 263 days.

CLIMATIC SUMMARY

Fritzsche AAF   Latitude 36°41′N   Longitude121°46′N   Elevation 40.8 m (134 ft)

PARAMETER DESCRIPTION		UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	YEARS OF RECORD
Temperature																
Absolute maximum temperature		(°C)	26.1	24.4	27.2	32.8	31.7	29.7	27.8	32.8	33.9	39.4	32.2	25.0	39.4	11
		(°F)	79	76	81	91	89	85	82	91	93	103	90	77	103	
Mean daily maximum temperature		(°C)	15.6	15.6	15.0	16.1	16.1	17.2	18.3	18.3	20.2	20.6	17.2	15.0	17.2	10
		(°F)	60	60	59	61	61	63	64	64	68	69	63	59	63	
Mean daily minimum temperature		(°C)	2.8	5.6	5.0	7.2	8.9	10.6	11.1	11.7	11.1	8.9	6.7	3.9	7.8	10
		(°F)	37	42	41	45	48	51	52	53	52	48	44	39	46	
Absolute minimum temperature		(°C)	−5.0	−4.4	−2.2	0.6	3.3	4.4	5.0	7.2	2.2	1.1	−2.2	−3.3	−5.0	11
		(°F)	23	24	28	33	38	40	41	45	36	34	28	26	23	
Mean no. days with maximum temperature ≧90° F (32.2° C)		days	0	0	0	#	0	0	0	0	#	1	#	0	1	10
Mean no. days with minimum temperature ≦32° F (0.0° C)		days	8	2	#	0	0	0	0	0	0	0	1	5	16	10
Mean dew point temperature		(°C)	3.9	6.1	5.6	6.1	8.3	9.4	10.6	11.1	10.6	8.9	7.2	4.4	7.8	11
		(°F)	39	43	42	43	47	49	51	52	51	48	45	40	46	
Precipitation and Humidity																
Mean percent relative humidity		%	75	78	75	70	77	78	80	83	80	76	77	77	77	6
Mean percent relative humidity at 0400 LST		%	83	87	85	82	87	88	90	93	89	85	85	84	87	11
Mean percent relative humidity at 1300 LST		%	57	61	59	60	65	67	69	71	64	58	59	60	63	11
Mean no. days with precipitation ≧0.01 in. (0.25 mm)		days	8	7	8	7	3	2	#	1	1	2	8	7	54	11
Mean no. days with precipitation ≧0.5 in. (12.7 mm)		days	2	1	1	1	0	0	#	0	0	#	1	2	8	11
Mean monthly precipitation		mm	73.7	50.8	53.3	50.8	5.1	2.5	2.5	#	2.5	10.2	53.3	55.9	360.7	11
		in	2.9	2.0	2.1	2.0	0.2	0.1	0.1	#	0.1	0.4	2.1	2.2	14.2	
Absolute maximum 24-hour precipitation		mm	43.2	48.3	45.7	38.1	7.6	5.1	17.8	5.1	7.6	17.8	48.3	38.1	48.3	9
		in	1.7	1.9	1.8	1.5	0.3	0.2	0.7	9.2	0.3	0.7	1.9	1.5	1.9	
*Absolute maximum monthly precipitation		mm	190.3	153.7	128.5	100.6	42.9	17.8	10.9	22.4	6.9	45.0	98.0	227.6	227.6	25
		in	7.5	6.1	5.1	4.0	1.7	0.7	0.4	1.0	0.3	1.8	3.9	9.0	9.0	
*Absolute minimum monthly precipitation		mm	2.5	0.3	0	0	0	0	0	0	0	T	0	7.5	0	25
		in	0.10	0.01	0	0	0	0	0	0	0	T	0	0.30	0	
Mean no. days with thunderstorms		days	#	#	#	0	#	#	#	0	1	#	#	#	1	10
Mean monthly snowfall		mm	25.4	0	0	0	0	0	0	0	0	0	#	0	25.4	11
		in	1	0	0	0	0	0	0	0	0	0	#	0	1	
Absolute maximum 24-hour snowfall		mm	102	0	0	0	0	0	0	0	0	0	#	0	102	9
		in	4	0	0	0	0	0	0	0	0	0	#	0	4	
Mean no. days with snowfall ≧0.1 in (2.5 mm)		days	#	0	0	0	0	0	0	0	0	0	0	0	#	11
Mean no. days with snowfall ≧1.5 in (38.1 mm)		days	#	0	0	0	0	0	0	0	0	0	0	0	#	11
Wind and Pressure																
Prevailing direction of wind		direction	E	W	W	W	W	W	W	W	W	W	E	E	W	11
Mean wind speed		kmph	9	9	9	11	13	13	13	13	9	9	7	7	11	11
		knots	5	5	5	6	7	7	7	7	5	5	4	4	6	
Extreme wind speed (peak gust)		kmph	82	93	69	74	74	70	48	52	54	74	78	78	93	10
		knots	44	50	37	40	40	38	26	28	29	40	42	42	50	
Vapor pressure		cm Hg	0.61	0.71	0.69	0.71	0.81	0.89	0.97	0.99	0.97	0.86	0.76	0.64	0.79	11
		in Hg	0.24	0.28	0.27	0.28	0.32	0.35	0.38	0.39	0.38	0.34	0.30	0.25	0.31	
Pressure altitude (99.95%)		m	137	152	122	107	92	107	92	107	107	107	137	137	137	7
		ft	450	500	400	350	300	350	300	350	350	350	450	450	450	
Percent frequency of surface wind speed ≧28 knots (32.2 mph or 51.9 kmph)		%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6
Percent frequency of surface wind speed ≧17 knots (19.6 mph or 31.5 kmph)		%	0.2	0.3	1.3	1.8	1.4	0.7	0.4	0.3	0.3	0.4	0.3	0.2	0.6	6
Mean no. days with surface wind ≧17 knots (19.6 mph or 31.5 kmph) and no precipitation	at 1600 LST	days	0.0	0.4	1.6	1.5	2.1	0.7	0.2	0.2	0.2	0.2	0.2	0.0	7.3	6
	at 2200 LST	days	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.6	6
	at 0400 LST	days	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.4	6
	at 1000 LST	days	0.0	0.0	0.2	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.9	6
Mean no. days 4 – 10 knots (4.6 – 11.5 mph or 7.4 – 18.5 kmph) and temperature 33 – 89° F (0.6 – 31.7° C) and no precipitation	at 1600 LST	days	24.9	22.0	18.1	16.7	15.3	16.4	13.1	12.9	21.6	24.1	25.4	23.3	233.8	6
	at 2200 LST	days	10.4	9.2	14.7	18.3	19.9	20.4	21.0	18.5	16.0	12.5	11.3	8.7	180.5	6
	at 0400 LST	days	14.7	8.7	10.1	9.5	14.5	13.7	13.0	13.8	7.3	8.7	10.4	14.6	139.0	6
	at 1000 LST	days	21.0	16.5	19.6	19.7	23.4	24.3	25.1	24.6	17.4	18.0	19.7	22.2	251.5	6
Visibility																
Mean cloudiness		tenths	5	6	5	5	6	6	6	6	5	5	5	5	5	11
Mean no. days with fog (visibility less than 7 mi or 11 km)		days	13	13	10	11	13	18	24	25	20	17	16	11	191	10
Mean no. days with an occurrence of visibility less than 0.5 mi (0.8 km)		days	5.0	4.8	1.8	4.3	4.7	5.8	11.7	13.9	11.2	8.8	8.2	7.2	87.4	6
Percent frequency ceiling ≦5000 ft (1524 m) or visibility ≦5 mi (8 km)		%	23.6	26.5	28.3	26.3	39.6	52.1	55.3	54.3	46.1	35.6	26.8	27.0	36.8	6
Percent frequency ceiling ≦1500 ft (457 m) or visibility ≦3 mi (4.8 km)	for 0000 – 0200 LST	%	11.8	19.6	9.0	15.8	26.2	49.8	57.1	58.1	45.6	34.3	19.0	14.1	30.0	6
	for 0300 – 0500 LST	%	11.8	19.6	12.3	20.9	36.1	61.3	72.0	72.3	54.1	38.3	18.9	14.4	36.0	6
	for 0600 – 0800 LST	%	11.8	21.5	11.8	22.5	38.9	61.7	76.7	71.5	57.1	36.1	20.2	18.3	37.3	6
	for 0900 – 1100 LST	%	10.5	9.5	6.2	9.6	20.1	33.9	48.4	42.0	31.6	13.8	9.6	13.3	20.7	6
	for 1200 – 1400 LST	%	4.1	5.7	4.1	4.0	12.5	15.7	26.7	26.3	24.4	8.0	2.7	6.7	11.7	6
	for 1500 – 1700 LST	%	3.9	7.8	6.7	7.5	17.0	24.3	39.2	40.4	30.0	23.7	8.9	10.3	18.3	6
	for 1800 – 2000 LST	%	5.6	13.0	9.2	11.2	21.5	42.4	55.2	53.3	38.4	29.0	15.6	13.3	25.6	6
	for 2100 – 2300 LST	%	7.7	14.4	7.7	10.8	21.5	45.3	57.7	48.2	43.3	29.2	16.4	13.5	26.3	6
Percent frequency ceiling ≦300 ft (91.4 m) or visibility ≦1 mi (1.6 km)	for 0000 – 0200 LST	%	3.9	5.4	2.4	3.9	3.9	10.7	23.7	31.2	17.5	18.5	12.8	9.5	12.0	6
	for 0300 – 0500 LST	%	3.7	5.7	4.3	6.7	10.3	12.9	31.7	34.9	23.8	21.0	11.4	10.6	14.8	6
	for 0600 – 0800 LST	%	6.0	9.2	4.1	9.2	9.5	8.3	22.9	29.4	24.9	21.1	13.6	13.1	14.3	6
	for 0900 – 1100 LST	%	4.1	3.3	0.2	0.8	0.2	0.0	0.9	0.7	2.2	3.9	3.1	7.3	2.2	6
	for 1200 – 1400 LST	%	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.9	0.2	0.9	0.2	6
	for 1500 – 1700 LST	%	0.6	0.9	0.4	0.2	0.4	0.2	0.2	0.7	1.1	4.1	3.1	3.7	1.3	6
	for 1800 – 2000 LST	%	1.3	3.3	0.6	1.3	3.6	4.3	9.0	12.8	6.7	9.7	7.1	6.0	5.5	6
	for 2100 – 2300 LST	%	2.4	4.7	1.9	2.3	3.0	7.1	17.5	22.5	13.6	13.1	9.6	6.5	8.7	6
Mean no. days with sky cover ≦30% and visibility ≧3 mi (4.8 km)	at 1600 LST	days	10.4	10.5	7.4	11.0	11.2	11.6	12.0	11.0	14.6	11.0	9.2	9.2	129.1	6
	at 2200 LST	days	14.4	13.9	12.6	14.6	13.5	11.8	11.2	13.2	14.8	14.0	14.4	16.2	164.6	6
	at 0400 LST	days	18.2	14.1	11.6	11.8	7.7	5.0	4.7	4.7	8.0	13.0	13.4	15.2	127.4	6
	at 1000 LST	days	11.8	10.5	8.6	8.6	10.5	11.0	10.0	11.4	13.0	15.0	7.4	12.6	130.4	6
Mean no. days with ceiling ≧1000 ft (305 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	30.2	26.4	29.8	28.6	27.7	25.5	21.6	19.7	22.6	25.0	27.6	28.4	313.1	6
	at 2200 LST	days	28.8	25.2	28.8	27.8	26.0	18.5	14.7	17.4	18.6	23.4	25.8	27.4	282.4	6
	at 0400 LST	days	28.2	23.6	27.8	24.9	21.8	15.3	9.5	9.9	13.8	21.4	25.0	25.4	246.6	6
	at 1000 LST	days	28.8	26.6	30.0	28.1	28.1	26.2	20.2	22.8	23.4	29.0	28.2	26.8	318.2	6
Mean no. days with ceiling ≧2000 ft (610 m) and visibility ≧3 mi (4.8 km) and surface wind ≦10 knots (11.5 mph or 18.5 kmph)	at 1600 LST	days	25.4	17.1	12.6	7.8	5.5	3.3	3.3	4.0	8.8	14.2	22.6	25.8	150.4	6
	at 2200 LST	days	25.0	22.4	25.8	22.1	17.5	10.5	8.2	10.2	15.0	20.2	23.6	26.2	226.7	6
	at 0400 LST	days	26.0	21.4	25.4	20.9	15.8	9.7	7.2	7.5	12.0	18.0	22.0	23.1	209.0	6
	at 1000 LST	days	21.6	20.8	23.4	21.3	17.0	14.6	11.5	16.1	19.0	24.6	23.8	23.0	236.7	6

CLIMATIC SUMMARY (Continued)

Fritzsche AAF   Latitude 36°41′N   Longitude 121°46′W   Elevation 40.8 m (134 ft)

PARAMETER DESCRIPTION		UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	YEARS OF RECORD
Visibility (cont'd)																
Mean no. days with ceiling ≧2500 ft (762 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	28.8	24.8	27.8	27.1	23.5	20.3	18.5	17.4	19.4	23.2	26.2	26.6	283.6	6
	at 2200 LST	days	27.0	22.8	26.6	24.5	20.8	14.6	13.1	16.2	15.8	20.8	24.6	26.4	253.2	6
	at 0400 LST	days	26.4	20.6	24.6	21.6	15.0	8.3	7.2	7.0	11.2	18.4	23.2	24.2	207.7	6
	at 1000 LST	days	27.0	23.2	26.6	26.1	22.2	17.3	15.3	17.7	19.4	26.0	26.2	25.4	272.4	6
Mean no. days with ceiling ≧6000 ft (1829 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	25.8	22.8	22.6	24.2	21.8	19.3	18.3	16.9	19.0	21.2	22.8	22.8	257.5	6
	at 2200 LST	days	23.4	20.6	21.2	22.0	19.5	14.5	13.1	16.1	15.6	19.0	22.0	22.4	229.4	6
	at 0400 LST	days	23.6	18.3	20.0	17.2	11.8	7.5	7.0	6.9	11.0	16.4	21.8	20.6	182.1	6
	at 1000 LST	days	24.0	20.4	22.4	21.0	19.0	15.5	15.2	17.4	18.4	23.6	22.0	21.6	240.5	6
Mean no. days with ceiling ≧10,000 ft (3048 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	24.4	20.0	21.4	23.0	21.1	19.1	18.3	16.7	18.2	20.4	21.8	21.6	246.0	6
	at 2200 LST	days	22.0	19.7	20.0	20.3	19.2	14.5	13.0	15.9	15.6	18.0	20.8	21.6	220.6	6
	at 0400 LST	days	22.8	17.1	18.4	16.4	11.7	7.5	7.0	6.9	10.8	15.6	20.4	19.6	174.2	6
	at 1000 LST	days	23.2	18.8	20.4	20.2	18.5	15.2	15.2	17.1	17.6	23.0	20.8	21.2	231.2	6

*These data are from nearby Salinas Municipal (CAA) Airport (Latitude 36°19′N, Longitude 121°36′W, elevation 84 ft, or 25.6 m), about 16 km or 10 mi east of the Fort Ord meteorological station.

LST = Local Standard Time
T = Trace
# = Less than ½ day or .5 in, as applicable.

EPHEMERIS FOR FORT ORD, CALIFORNIA
(Pacific Standard Time)

DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET
January 1	0619	1803	0720	1702
January 11	0619	1811	0720	1711
January 21	0617	1820	0716	1721
February 1	0611	1831	0709	1733
February 11	0603	1840	0700	1743
February 21	0552	1850	0648	1754
March 1	0542	1857	0638	1801
March 11	0529	1906	0624	1811
March 21	0514	1916	0610	1820
April 1	0457	1926	0553	1829
April 11	0441	1936	0539	1838
April 21	0426	1946	0526	1846
May 1	0412	1957	0514	1855
May 11	0400	2007	0503	1904
May 21	0350	2019	0455	1912
June 1	0343	2027	0450	1920
June 11	0339	2034	0448	1926
June 21	0340	2038	0448	1929
July 1	0343	2038	0452	1930
July 11	0350	2035	0457	1927
July 21	0358	2028	0504	1922
August 1	0409	2017	0513	1914
August 11	0419	2004	0521	1903
August 21	0429	1950	0529	1851
September 1	0440	1933	0538	1836
September 11	0449	1919	0546	1821
September 21	0458	1902	0554	1806
October 1	0506	1847	0602	1751
October 11	0515	1832	0611	1736
October 21	0523	1820	0620	1723
November 1	0533	1808	0630	1710
November 11	0542	1800	0641	1701
November 21	0552	1754	0651	1655
December 1	0600	1752	0701	1651
December 11	0608	1752	0709	1651
December 21	0614	1756	0716	1655

I. CROSS-COUNTRY MOVEMENT

Cross-country movement (CCM) conditions, or off-road movement, at Fort Ord are shown on the accompanying map. Additional details are provided in the following text and table. CCM conditions have been derived mainly from vegetation, soils, and surface configuration data prepared for and appearing separately in this terrain analysis. Supplemental sources included 1:12,000 scale aerial photography, topographic maps, field notes and photography, and miscellaneous textual material.

The map and predicted movement evaluations should be used only as guides in planning military training activities. For exact movement routes, reconnaissance on the ground is recommended. Data on the terrain factors and the evaluations are generalized to suit the scale of the map. Many areas of minor areal extent such as small tracts of forest, cleared areas, short sharp slopes, and depressions, are too small to portray.

The predicted movement ratings are those believed to prevail during most of the year. Variations in these evaluations may occur from year to year, and even within a season, due to abnormal variations in the weather. Normally, movement will be degraded two or three days per month during the period from about mid-November through mid-April, the time of the winter rains. However, due to the generally well-drained sandy soils covering much of the reservation, these degraded conditions linger only for a day or two after rain stops.

The evaluations are based on terrain conditions as they are known at present. Future alterations of the terrain, such as timber clearing operations, dam and reservoir building, and road construction, would obviously change cross-country movement conditions.

Built-up areas, such as urban and cantonment areas, are not evaluated on this map.

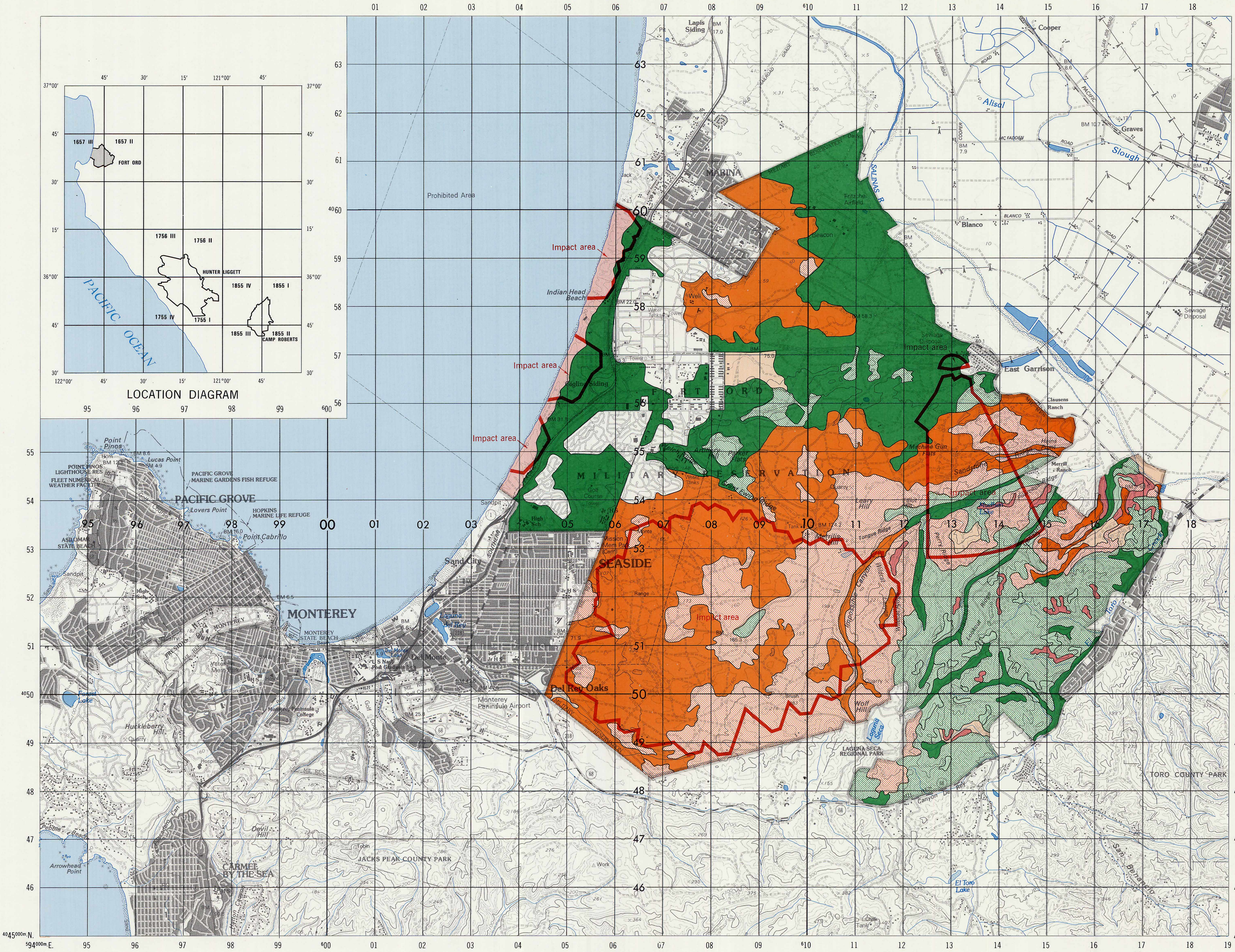
Movement in the indicated impact areas may be restricted during periods of live fire. Caution should be taken when moving through these areas because of the existence of unexploded ammunition.

GENERAL TERRAIN AND MOVEMENT DESCRIPTION

MAP UNIT	GENERALIZED TERRAIN CONDITIONS	MOVEMENT OF TRACKED VEHICLES 1/	MOVEMENT OF WHEELED VEHICLES 2/	MOVEMENT OF FOOT TROOPS
1	Gently sloping grass-covered lowlands in the northern and western portion of the Fort and narrow valleys in the eastern. Most slopes less than 5 percent, a few range to 8 percent. Soils predominantly deep sandy loams and loamy sands. Small clayey loam concentrations in depressions. Grasses range less than 1 m (3 ft) high. Widely scattered trees up to 8 m (25 ft) in height and 64 cm (25 in) in diameter, or clusters of trees (mostly oaks) and brush. Trees somewhat more extensive in northern and central parts of the reservation; open, short, grass-covered areas predominate in the vicinity of Fritzche Airfield. Where undergrowth does occur, poison oak is common.	Generally easy in any direction for both tank and APC. Local obstructions, such as scattered clusters of oaks, can be easily bypassed. Predominantly sandy soil soaks up rain and maintains low water table; therefore, movement not greatly hindered by wet weather. Grass cover reduces dust problems during maneuvers in dry weather. Narrow valleys in eastern portion restrict movement and should be avoided anytime there is a possibility of flash flooding.	Fairly easy most of the time in any direction for both the truck and jeep. Slipperiness will somewhat slow movement in clayey areas when wet. Very sandy soils, when dry and loose, will slow movement. Narrow valleys on eastern side of area restrict movement and drainage channels slow vehicle speeds. Valleys should be avoided anytime there is a possibility of flash flooding.	Unhindered in most places. Slightly hindered in areas of poison oak, which should be avoided. Local areas of dry, loose sand will moderately slow movement. Narrow valleys on eastern side should be avoided during wet periods and anytime there is a possibility of flash flooding.
2	Moderately sloping grasslands located in the eastern uplands, with some small areas in the central portion of the Fort. Most slopes between 8 and 20 percent, with few up to 30 percent. Soils mainly sandy or loamy and generally firm. Vegetation dominated by short grasses less than 1 m (3 ft) in height with widely scattered trees or clumps of trees covering approximately 10 percent of the area. Portions of the area are currently used for grazing livestock.	Generally unrestricted throughout the year. Scattered clumps of trees and other local obstacles easily bypassed. Soft soil conditions, seldom exceeding a day or two after winter rains, may complicate tank movement on eastern area slopes. APC movement somewhat less hindered than tank.	Moderately hindered by steeper slopes in the area. Upslope movement on wet grass is severely restricted. Grass sod assists in vehicle traction and weight support in loamy areas. Dry, loose sand areas on steep slopes are a major hinderance; jeep less affected in this area than tank.	Unhindered in most places. Wet and slippery grasses during and immediately after rains are a slight hinderance.
3	Moderately to highly dissected grass-covered uplands located in the eastern portion of the Fort generally along stream valley walls. Terrain similar to Map Unit 2 except slopes steeper and ground surfaces more uneven. Slopes mostly between 30 and 45 percent. Soils characterized by mixed sandy loam, or coarse sandy loam, and containing varying amounts of gravel, cobbles, and stones. Ridges chiefly covered with low-growing grasses with some trees or clumps of trees commonly concentrated along drainage channels.	Moderately slowed by steepness of slopes. Local clumps of trees easily bypassed. Soils offer firm support when surface dry or wet. Loose sand areas and areas where grass has been torn from surface by movement in trace, restrict manuevering. Wet grassy slopes an additional hinderance during or after rains.	Moderately to severely restricted by steepness of slopes. Slipperiness of grass during wet periods precludes movement on steeper slopes. Soils offer firm supporting surface dry or wet. Stony areas restrict jeep more than truck.	Movement slowed by steep slopes. In wet weather, slipperiness of grasses hinders movement. Stony areas slow rate of movement.
4	Gently rolling low hills in the central portion of the Fort with some small scattered areas in the northeastern part. Area includes some narrow stream valleys. Slopes gentle, less than 8 percent. Soils predominately gravelly sands and loamy sands. Vegetation consists of moderate to dense low growing scrub, brush, and thickets up to 0.75 m (2 ft) in height. Large portion of this area is located in the southern impact area.	Moderate restricted by areas of dense vegetation; otherwise, movement easy over entire area. Tracked vehicles can usually chew way through this type of obstacle. Narrowness of some stream valleys further limit movement in this map unit area.	Severely restricted by areas of dense vegetation. Truck will maneuver better here than jeep. Streambanks in narrow valleys an additional hinderance to movement.	Moderately restricted by large clumps of dense vegetation which must be bypassed. During and after precipitation wetness of foliage will further hinder movement.
5	Moderately sloping areas mostly in the central portion of the Fort. Eastern portions of area comprised of steep bluffs, fans, benches, and entrenched streams and gullies. Some small scattered areas in the northeast, adjacent to the stream valleys. Other than slope, terrain characteristics very similar to Map Unit 4 except slopes steeper, generally between 8 and 30 percent.	Moderately restricted by areas of dense vegetation and by locally steep slopes in dissected eastern regions. In wet weather, slipperiness of steeper slopes and wet vegetation severely hinder movement.	Severely restricted by areas of dense vegetation and by dissected terrain in the eastern regions. During and after rain, the combined effect of slippery vegetation and steep slopes render much of this area unsuited for wheeled vehicles.	Moderately restricted by large clumps of dense vegetation which must be bypassed. Severely hindered by slippery slopes and wet vegetation during bad weather.
6	Widely scattered areas of heavy forest cover; mostly found in the eastern uplands with one medium-sized area adjacent to urban area in northcentral part of the Fort. Slopes of all categories, from less than 3 percent to greater than 100 percent, occur in this map unit. Soils highly varied in composition. Vegetation mostly small deciduous trees, a few up to 15 m (49 ft) high, closely-spaced, 1 to 4 m (3 to 13 ft), with widely varying diameters. Dominant trees include live oak, willow, black cottonwood, California sycamore, and buckeye. Dense understory of leafy brush in most places.	Generally prohibited in most of map unit area due primarily to closely spaced trees. Soils normally no hinderance, but stream channels are an additional obstacle.	Trucks generally prohibited in most of map unit area due primarily to closely spaced trees. Local movement by jeep possible, but much maneuvering necessary. Thick undergrowth and stream channels additionally restrict movement.	Movement severely restricted when trees and undergrowth are in full leaf. At other times, moderately restricted.
7	Coastal beach and sand dune area on the western edge of the Fort. Slopes irregular; vary from level to greater than 45 percent. Soils are generally highly permeable loose sands forming hummocks, mounds, hills, and coastal beaches. Vegetation consists of adapted grasses and forbs. In most of map unit area movement not practical due to loose sand. Disturbance of dunes could be environmentally damaging as destruction of thin vegetation cover could cause dunes to start moving inland.	Not practical due to loose sand and irregular slopes. Movement along narrow moist beach zone feasible. Locally, movement for short distances possible on stabilized dunes.	Impractical due to loose sand or steep slopes. Movement feasible along narrow moist beach zone.	Severely restricted by loose sand which is difficult to walk in. Best movement along narrow moist beach zone.
8	Small scattered rugged areas along the side of canyons and stream terraces in the eastern uplands of the Fort. Slopes range from moderate to steep, generally from 30 to greater than 45 percent. Soils predominantly sands and clays over unweathered bedrock. Vegetation consists of dense brush and thickets with some scattered stands of trees.	Tank and APC movement severely restricted due to steep slopes and dense vegetation.	Preculed at all times by dense vegetation and steep slopes.	Movement slow but possible even in wet weather.
9	Built-up areas with medium to high density of construction, such as urban and cantonment areas.	Not evaluated.	Not evaluated.	Not evaluated.

1/ Comments apply to the M-60 tank and the M-113 armored personnel carrier (APC).

2/ Comments apply to the M-35, 2½ ton truck and the M-151, ¼ ton truck.



FORT ORD, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS

SUPPLEMENTARY CONTOURS 10 METERS

CROSS-COUNTRY MOVEMENT

EVALUATION OF TERRAIN FOR CROSS-COUNTRY MOVEMENT

MAP UNIT	TERRAIN UNIT	PREDICTED MOVEMENT RATINGS FOR:				
		TANK (M-60)	APC (M-113)	2½t TRUCK (M-35)	¼t JEEP (M-151)	FOOT TROOPS
1	Gently sloping grasslands crossed by a few narrow valleys.	Good	Good	Good	Good	Good
2	Moderately sloping grasslands with widely scattered trees or clumps of trees.	Good	Good	Fair	Fair	Good
3	Moderately to highly dissected grass-covered uplands.	Fair	Fair	Poor	Fair	Fair
4	Moderate to dense brush, scrub or thickets; slopes mostly gentle.	Fair	Fair	Poor	Poor	Fair
5	Moderate to dense brush, scrub or thickets; slopes moderate to steep.	Fair	Fair	Poor	Poor	Fair
6	Densely forested areas, mostly uplands.	Unsuited	Unsuited	Unsuited	Unsuited	Fair
7	Predominantly coastal sand dunes	Unsuited	Poor	Unsuited	Unsuited	Poor
8	Mostly steep, brushcovered or eroded canyon slopes and terraces.	Unsuited	Unsuited	Unsuited	Unsuited	Poor
OPEN 9	Built-up areas	Urban and built-up areas not evaluated				

Impact area boundary

NOTE: Impact areas may be restricted during periods of live fire. Caution should be taken when moving through these areas because of the existence of unexploded munitions.

EXPLANATION OF RATING TERMS

Good– Conditions permit free movement in any direction. Terrain will permit 12 or more vehicle passes in trace or permit at least one maneuver (starts, stops, sharp turns, or crossing of tracks) at one location.

Fair– Conditions moderately hinder progress or moderately restrict choices of direction for movement. Terrain will permit 3 to 12 passes in trace but maneuvering will be difficult.

Poor– Conditions severly hinder progress or greatly restrict choice of movement routes. Terrain will probably permit up to 3 passes in trace. Very cautious driving required. Movement in trace should be avoided, when possible.

Unsuited– Conditions preclude all but local movement. Engineering work required for vehicular movement.

Cross-country movement (CCM) conditions, or off road movement, at Fort Ord, are shown on the accompanying map. Additional details are provided in the following text and table. CCM conditions have been derived mainly from vegetation, soils, and surface configuration data prepared for and appearing separately in this terrain analysis. Supplemental sources included aerial photography, topographic maps, field notes and photography, and miscellaneous textual material.

The map predicted movement evaluations should be used only as guides in planning military training activities. For exact movement routes, reconnaissance on the ground is recommended. Data on the terrain factors and the evaluations are generalized to suit the scale of the map. Many areas of minor areal extent such as small tracts of forest, cleared areas, short sharp slopes, and depressions, are too small to portray.

The predicted movement ratings are those believed to prevail during most of the year. Variations in these evaluations may occur from year to year, and even within a season, due to abnormal variations in the weather. Normally, movement will be degraded two or three days per month during the period from about November through April, the time of winter rains. During periods of dry weather severe dust problems may occur in areas with little or no vegetation, causing limited visibility.

The evaluations are based on terrain conditions as they are known at present. Future alterations of the terrain, such as timber clearing operations, dam and reservoir building, and road construction, would obviously change cross-country movement conditions.

Built-up areas, such as urban and cantonment areas, are not evaluated on this map.

Movement in the indicated impact areas may be restricted during periods of live fire. Caution should be taken when moving through these areas because of the existence of unexploded ammunition.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

J. LINES OF COMMUNICATION

Lines of Communication (LOC) at Fort Ord and Presidio of Monterey are depicted on the accompanying map. Supportive information for LOC as shown on the graphic is provided in the tables following this summary.

ROADS: The road network of Fort Ord consists of hard surface, loose surface, improved and unimproved dirt roads. The length of the system on the map is approximately 370 kilometers (230 miles), of which 153 kilometers (95 miles) are hard surface. Many minor hard surface and dirt roads have been omitted from the graphic. Selected dirt roads depict prevailing patterns and system connections. Data on military load classification and road shoulder characteristics are not available but the main roads connecting major functional areas have a high wheel-loading capacity. The Main Garrison is laid out in a block system of numbered avenues (north-south) and streets (east-west), with most of the major thoroughfares identified as roads. State Highway 1, a north-south coastal route that traverses Fort Ord along the coastline is especially important to reservation communications. The road network of Presidio of Monterey shown on the map consists of hard surface roads in good to excellent condition. The length of the system shown is approximately 5 kilometers (3 miles). The Presidio of Monterey is also served by State Highway 1. Refer to Roads, Fort Ord, and Roads, Presidio of Monterey, for individual road detail.

ROAD BRIDGES: There are seven road bridges on Fort Ord, four of which are rated as being in good condition, and one is rated as being in poor condition and two have no data available. Road Bridges, Fort Ord, provides available details pertaining to each bridge.

RAILROADS: The Southern Pacific Railroad Company has a branch line from the main coastal route to Monterey. It branches off at Castroville, 12.9 kilometers (8 miles) to the north. The Southern Pacific Railroad Company serves the main cantonment area of Fort Ord, but there is no rail line access to the East Garrison. Federally owed track is limited to sidings on the reservation. Total length of trackage within the reservation is approximately 6.4 kilometers (4 miles). Ord Siding has a storage capacity of 86 cars, and the Workfield Siding has a storage capacity of 12 cars. The volume of traffic ranges from 25 to 99 cars per month for both the private line and sidings. For details refer to railroads, Fort Ord.

AIRFIELDS: There is one airfield located within the reservation boundary. Fritzsche Army Airfield, northeast of the main post, provides service for both fixed wing and rotary wing operations. Refer to Airfields, Fort Ord, for additional information.

PIPELINES: There are two types of supply pipelines on Fort Ord. The Pacific Gas and Electric Company has 10-inch high pressure mains supplying natural gas at 300 psi. The main line from Salinas enters the post just south of East Garrison and roughly follows Inter-Garrison Road, the 8th Street cut-off, and 8th Street itself to 1st Avenue. There it joins with the main between Marina and Seaside. The line along Anza Road is a trunk line supplying the Roger S. Fitch Jr. High School. Water is supplied from the well fields to the large reservoirs on the east side of the cantonment area. These reservoirs are connected by a 24-inch steel, cement-lined pipe. An eight-inch cast iron line supplies water to the water tower at Fritzsche Army Airfield. Water at the Presidio of Monterey is supplied by the California-American Water Company from wells in Carmel Valley. Refer to Pipelines, Fort Ord & Presidio of Monterey, for additional details.

HELICOPTER LANDING ZONES (HLZ): There are five recognized HLZs on Fort Ord and one at the Presidio of Monterey. As previously mentioned, Fritzsche Army Airfield is the prime site used for helicopter landings. For details on this and other designated HLZ sites refer to Helicopter Landing Zones, Fort Ord and Presidio of Monterey. There are no Drop Zones (DZs) as such on Fort Ord; however, the Parachute Club does use one end of the airfield for its practice.

1. ROADS

ROUTE NUMBER NAME 1/	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ MATERIAL	REMARKS
A Street	078568	083568	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Excellent	No data	No data	
Anza Avenue	050534	059534	0.8 km (0.5 mi)	No data	All-weather	Low Bituminous	8.5 m (28 ft); Good	No data	No data	
Arnhem Road	074559	074561	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
B Street	079565	083565	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Excellent	No data	No data	
Barloy Canyon Road	134565	115498	7.6 km (4.7 mi)	No data	All-weather	Bituminous	7.3m (24 ft); No data	No data	No data	
Beach Range Road	040543	062591	5.7 km (3.5 mi)	No data	All-weather	Medium & Low Bituminous	7.3 m (24 ft); Good	No data	No data	
Segment 1	040543	048554	1.5 km (0.9 mi)	No data	All-weather	Medium Bituminous	7.3 m (24 ft); Good	No data	No data	
Segment 2	048554	062591	4.2 km (2.6 mi)	No data	All-weather	Low Bituminous	7.3 m (24 ft); Good	No data	No data	
Blanco Road	112584	118595	1.2 km (0.8 mi)	No data	All-weather	No data	No data	No data	No data	
C Street	079564	083564	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Excellent	No data	No data	
Chapel Hill Road	133567	134572	0.6 km (0.4 mi)	No data	All-weather	Low Bituminous	6.1 m (20 ft); Good	No data	No data	
Coe Avenue	042542	050534	1.2 km (0.7 mi)	No data	All-weather	Low Bituminous	8.5 m (28 ft); Good	No data	No data	
Corps Place	063585	063588	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Good	No data	No data	
Cresent Bluff Road	134563	143558	1.1 km (0.7 mi)	No data	All-weather	Medium Bituminous	6.7 m (22 ft); No data	No data	No data	
Eighth Street	060578	074576	1.3 km (0.8 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); 11.6 m (38 ft); 7.9 m (26 ft); Good 9.8 m (32 ft); Excellent	No data	No data	
Segment 1	060578	065578	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
Segment 2	065578	068578	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	9.8 m (32 ft); Excellent	No data	No data	
Segment 3	068578	071578	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	11.6 m (38 ft); Good	No data	No data	
Segment 4	071578	074576	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Good	No data	No data	
Eighth Street	074576	082570	1.0 km (0.6 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Good	No data	No data	
Eleventh Street	061583	067585	0.8 km (0.5 mi)	No data	All-Weather	Asphaltic Concrete	12.2 m (40 ft); 8.5 m (28 ft); Good	No data	No data	
Segment 1	061583	065584	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	12.2 m (40 ft); Good	No data	No data	
Segment 2	065584	067585	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
Engineer Road	159529	165547	2.3 km (1.4 mi)	No data	Fair-weather	Dirt	6.1 m (20 ft); Fair to Poor	No data	No data	
Eucalyptus Road	059533	126538	7.3 km (4.6 mi)	No data	All-weather	Low Bituminous	8.5 m (28 ft); Good	No data	No data	Road may become slippery and miry after heavy rains particularly during the winter and spring.
Fifth Avenue	078568	078570	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Fifth Avenue	060573	071574	1.1 km (0.7 mi)	No data	All-weather	Asphaltic Concrete	12.2 m (40 ft); 8.2 m (27 ft); Good	No data	No data	
Segment 1	060573	065573	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Segment 2	065573	071574	0.6 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	12.2 m (40 ft); Good	No data	No data	
First Avenue	060568	062562	2.6 km (1.7 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); 11.6 m (38 ft); 9.1 m (30 ft); Good 7.3 m (24 ft); Excellent	No data	No data	
Segment 1	060568	060578	0.9 km (0.6 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
Segment 2	060578	061585	0.7 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	11.6 m (38 ft); Good	No data	No data	
Segment 3	062562	060568	0.6 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); Good	No data	No data	
Segment 4	062559	062562	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
First Street	061568	078568	1.7 km (1.1 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
Fourth Avenue	071570	073585	0.2 km (1.2 mi)	No data	All-weather	Asphaltic Concrete	9.8 m (32 ft); 8.2 m (27 ft); 11 m (36 ft); Good 7.3 m (24 ft); Excellent	No data	No data	
Segment 1	071570	071578	0.7 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	9.8 m (32 ft); Good	No data	No data	
Segment 2	072568	072570	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Segment 3	073585	072579	0.7 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	11 m (36 ft); Good	No data	No data	
Segment 4	073585	075589	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	

1. ROADS (Continued)

ROUTE NUMBER/ NAME 1/	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ MATERIAL	REMARKS
Fourth Street	060572	071571	0.8 km (0.5 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Segment 1	060572	065572	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Segment 2	068571	071571	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Fitzsche Army Airfield Road	100600	103590	1.5 km (1.0 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Excellent	No data	No data	
Gigling Road	062558	108560	4.8 km (3.1 mi)	No data	All-weather	Asphaltic Concrete	12.2 m (40 ft); 11.3 m (37 ft); 8.2 m (27 ft);	No data	No data	
						Bituminous	7.3 m (24 ft); Good			
Segment 1	062558	068558	0.6 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	12.2 m (40 ft); Good	No data	No data	
Segment 2	068558	075558	0.6 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	11.3 m (37 ft); Good	No data	No data	
Segment 3	075558	083558	0.9 km (0.6 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Segment 4	083558	108560	2.7 km (1.7 mi)	No data	All-weather	Bituminous	7.3 m (24 ft); Good	No data	No data	
Imjin Road	077575	103589	3.2 km (2 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
Inter-Garrison Road	083570	134572	5.2 km (3.2 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Good	No data	No data	
Jacks Road	143530	169526	3.5 km (2.2 mi)	No data	Fair-weather	Dirt	6.1 m (20 ft); No data	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Kit Carson Drive	139567	140568	0.2 km (0.1 mi)	No data	All-weather	Low Bituminous	7.9 m (26 ft); Fair	No data	No data	
McClure Way	056543	061541	0.6 km (0.4 mi)	No data	All-weather	Low Bituminous	6.1 m (20 ft); Good	No data	No data	
Main Gate Road	061562	069563	0.8 km (0.5 mi)	No data	All-weather	Asphaltic Concrete	14.6 m (48 ft); Excellent	No data	No data	
Monterey Road	038535	065559	4 km (2.4 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); 10 m (33 ft); Excellent	No data	No data	
Segment 1	038535	044543	1.2 km (0.7 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
Segment 2	044543	065559	2.8 km (1.7 mi)	No data	All-weather	Asphaltic Concrete	10 m (33 ft); Excellent	No data	No data	
Ninth Street	060579	076578	1.8 km (1.1 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); 9.8 m (32 ft); 6.4 m (21 ft); 7.3 m (24 ft); Good	No data	No data	
Segment 1	060579	068579	0.7 km (0.4 mi)	No data	All-Weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Segment 2	068580	074578	0.6 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	9.8 m (32 ft); Good	No data	No data	
Segment 3	074578	075576	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	6.4 m (21 ft); Good	No data	No data	
Segment 4	074578	076578	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Good	No data	No data	
Normandy Road	065551	075551	1.0 km (0.6 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
North-South Road	046500	071568	7.2 km (4.5 mi)	No data	All-weather	Asphaltic Concrete	9.8 m (32 ft); 6.7 m (22 ft); 13.4 m (44 ft); Excellent	No data	No data	
							7.3 m (24 ft); Good			
Segment 1	046500	059533	3.6 km (2.2 mi)	No data	All-weather	Asphaltic Concrete	9.8 m (32 ft); Excellent	No data	No data	
Segment 2	059533	063546	1.3 km (0.8 mi)	No data	All-weather	Asphaltic Concrete	6.7 m (22 ft); Excellent	No data	No data	
Segment 3	063546	070564	1.9 km (1.2 mi)	No data	All-weather	Asphaltic Concrete	13.4 m (44 ft); Excellent	No data	No data	
Segment 4	070564	071568	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Good	No data	No data	
North Camp Street	126570	133569	0.7 km (0.4 mi)	No data	All-weather	Low Bituminous	6.1 m (20 ft); Poor	No data	No data	
Numa Watson Road	073548	073551	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
Oil Well Road	137509	169526	5 km (3.1 mi)	No data	Fair-weather	Dirt	6.1 m (20 ft); No data	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Old Country Road	091591	124572	4 km (2.5 mi)	No data	Fair-weather	Dirt	6.1 m (20 ft); Fair to Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Old South Boundary Road	047502	115498	8.2 km (5.1 mi)	No data	All-weather	Bituminous	6.7 m (22 ft); Good	No data	No data	
Ord Avenue	038534	046538	0.9 km (0.6 mi)	No data	All-weather	Low Bituminous	6.7 m (22 ft); Fair	No data	No data	
Ord Avenue	134572	139568	0.6 km (0.4 mi)	No data	All-weather	Medium Bituminous	19 m (65 ft); Good	No data	No data	
Owen Durham Street	071559	083561	1.4 km (0.8 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
							6.1 m (20 ft); Good			
Segment 1	071559	075561	0.7 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
Segment 2	075561	083561	0.7 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data	
Parker Flats Road	075551	089550	1.6 km (0.9 mi)	No data	All-weather	Low Bituminous	7.3 m (24 ft); Good	No data	No data	
Parker Flats Cut-Off	075558	081543	1.8 km (1.2 mi)	No data	All-weather	Low Bituminous	7.3 m (24 ft);	No data	No data	
						Asphaltic Concrete	7.9 m (26 ft); Good	No data	No data	
Segment 1	075551	081543	1.1 km (0.8 mi)	No data	All-weather	Low Bituminous	7.3 m (24 ft); Good	No data	No data	
Segment 2	075551	075558	0.7 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Good	No data	No data	
Pilarcitos Road	120496	143532	4.5 km (2.8 mi)	No data	Fair-weather	Dirt	7.3 m (24 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Quartermaster Avenue	060569	060578	0.8 km (0.5 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); Good	No data	No data	
Reservation Road	092596	127576	3.9 km (2.4 mi)	No data	All-weather	Asphaltic Concrete	15.2 m (50 ft); Excellent	No data	No data	
Richardson Gate Road	136568	139566	1.0 km (0.6 mi)	No data	All-weather	Medium Bituminous	19.8 m (65 ft); 9.8 m (32 ft); Good	No data	No data	
Segment 1	136568	135566	0.2 km (0.1 mi)	No data	All-weather	Medium Bituminous	19.8 m (65 ft); Good	No data	No data	
Segment 2	135566	139566	0.8 km (0.5 mi)	No data	All-weather	Medium Bituminous	9.8 m (32 ft); Good	No data	No data	

1. ROADS (Continued)

ROUTE NUMBER/ NAME 1/	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ CONDITION	REMARKS
Second Avenue	065584	065568	1.5 km (0.9 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); Good	No data	No data	
Second Street	061569	065569	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Seventh Avenue	083559	083570	1.3 km (0.8 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Excellent	No data	No data	
Seventh Street	060576	065576	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Sherman Street	133571	139567	0.7 km (0.4 mi)	No data	All-weather	Medium Bituminous	11.3 m (37 ft); Fair	No data	No data	
Sixth Avenue	079559	079574	1.6 km (1.0 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Excellent 7.9 m (26 ft); Good	No data	No data	
Segment 1	079559	079570	1.3 km (0.8 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Excellent	No data	No data	
Segment 2	079570	079574	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	7.9 m (26 ft); Good	No data	No data	
Sixth Street	060575	065575	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Skyland Road	120496	143532	5.0 km (3.0 mi)	No data	Fair-weather	Dirt	7.3 m (24 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
South Camp Street	126568	133568	0.7 km (0.4 mi)	No data	All-weather	Low Bituminous	6.1 m (20 ft); Poor	No data	No data	
State Highway 1	039540	067598	6.8 km (4.2 mi)	No data	All-weather	Concrete	15.2 m (50 ft); excluding the median strip, Excellent	Bituminous	3 m (10 ft); Excellent	4 lanes, divided
Tenth Street	060581	069581	0.8 km (0.5 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
Third Avenue	068568	084584	3.2 km (2.0 mi)	No data	All-weather	Asphaltic Concrete	8.5 m (28 ft); Good	No data	No data	
Third Street	061570	083570	2.3 km (1.3 mi)	No data	All-Weather	Asphaltic Concrete	9.1 m (30 ft); Fair 8.2 m (27 ft); Good	No data	No data	
Segment 1	061570	065570	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); Fair	No data	No data	
Segment 2	065570	083570	1.8 km (1.1 mi)	No data	All-weather	Asphaltic Concrete	8.2 m (27 ft); Good	No data	No data	
Thirteenth Street	063588	067588	0.5km (0.3 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); Good	No data	No data	
Twelfth Street	062585	073585	1.3 km (0.9 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); 11 m (36 ft); Good	No data	No data	
Segment 1	062585	070586	0.9 km (0.6 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); Good	No data	No data	
Segement 2	070586	073585	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	11 m (36 ft); Good	No data	No data	
Viscanino Street	043536	045535	0.2 km (0.1 mi)	No data	All-weather	Bituminous	6.7 m (22 ft); No data	No data	No data	
Watkins Gate Rd	050512	135567	12.8 km (7.9 mi)	No data	All-weather	Low Bituminous	6.1 m (20 ft); Good & Fair	No data	No data	
Segment 1	050512	108560	9.8 km (6 mi)	No data	Fair-weather	Dirt	6.1 m (20 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Segment 2	108560	135567	3 km (1.9 mi)	No data	All-weather	Low Bituminous	6.1 m (20 ft); Fair	No data	No data	
West Camp Street	125572	126567	0.5 km (0.3 mi)	No data	All-weather	Low Bituminous	6.7 m (22 ft); Good	No data	No data	
Feeder Streets in Housing Areas			32.3 km (20 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
Unnamed Road	073582	074578	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	6.4 m (21 ft); Good	No data	No data	
Unnamed Road	074571	075576	0.5 km (0.3 mi)	No data	All-weather	Medium Bituminous	7.3 m (24 ft); Fair	No data	No data	
Unnamed Road	084552	085558	1 km (0.6 mi)	No data	All-weather	Bituminous	6.7 m (22 ft); No data	No data	No data	
Unnamed Road	089550	101534	2.2 km (1.4 mi)	No data	All-weather	Bituminous	6.7 m (22 ft); No data	No data	No data	
Additional Installation Routes (unnamed)										
Improved Dirt Roads			60 km (37.3 mi)	No data	Fair-weather	Dirt	4.3-9.1 m (14-30 ft); Good to poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Unimproved Dirt Roads			125 km (77.8 mi)	No data	Fair-weather	Dirt	3.4-7.3 m (11-24 ft); Good to poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.

1/ Names listed Alphabetically

1. ROADS (Continued)

ROADS, PRESIDIO OF MONTEREY

ROUTE NUMBER NAME 1/	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ MATERIAL
Artillery Street	985514	989514	0.4 km (0.3 mi)	No data	All-Weather	Asphaltic Concrete	6.4 m (21 ft); Good	No data	No data
Kit Carson Road	975515	981516	0.7 km (0.5 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); 6.7 m (22 ft); Good	No data	No data
Segment 1	975515	978516	0.4 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data
Segment 2	978516	981516	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	6.7 m (22 ft); Good	No data	No data
Lawton Road	975516	976513	0.3 km (0.2 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data
Patton Avenue	983516	984514	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data
Plummer Street	981516	987518	0.6 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	No data Good	No data	No data
Pvt Bolio Road	975516	987518	1.3 km (0.9 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data
Rifle Range Road	972515	976512	0.7 km (0.4 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); 7.6 m (25 ft); Good	No data	No data
Segment 1	972515	976512	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	9.1 m (30 ft); Good	No data	No data
Segment 2	974512	976512	0.2 km (0.1 mi)	No data	All-weather	Asphaltic Concrete	7.6 m (25 ft); Good	No data	No data
Stilwell Avenue	981513	981518	0.5 km (0.3 mi)	No data	All-weather	Asphaltic Concrete	9.8 m (32 ft); Excellent	No data	No data

1/ Names listed Alphabetically

ROAD BRIDGES

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION	DIMENSIONS LENGTH/OVERALL WIDTH/ ROADWAY WIDTH	CLEARANCE	TYPE/CONSTRUCTION MATERIALS	CONDITION	REMARKS
1	Twelfth Street	061586	State Highway 1	No data; civilian design of H-20, S-20-12, H20-S16 or HS20	60.5 m (198 ft) long; overall width – No data; 12.2 m (40 ft) roadway width.	Unlimited vertical; horizontal – No data; 5.2 m (17 ft) underbridge to both northbound and southbound lanes.	Deck; concrete boxed girder	Good	Built in 1973; Cal. Dept. of Trans. bridge No. BR 44-203
2	Eighth Street	059578	State Highway 1	No data; civilian design of H-20, S-20-12, H20-S16 or HS20	105 m (342 ft) long; overall width – No data; 12.2 m (40 ft) roadway width.	Unlimited vertical; horizontal – No data; 5.2 m (17 ft) northbound and 4.9 m (16.1 ft) southbound underbridge.	Deck; concrete boxed girder	Good	One sidewalk 1.5 m (5 ft) wide; built 1973; Cal. Dept. of Trans. bridge No. BR 44-202
3	Fort Ord Main Gate Road	060562	State Highway 1	No data; civilian design of H-20, S20-12, H20-S16 or HS20.	80 m (262 ft) long; overall width – No data; 17.8 m (58 ft) roadway width.	Unlimited vertical; horizontal – No data; 5.2 m (17.1 ft) northbound and 6.7 m (22 ft) southbound underbridge.	Deck; prestressed concrete grider	Good	Built in 1973; Cal. Dept. of Trans. bridge No. BR 44-199
4	Guidotti Road	149492	El Toro Creek	No data	39.6 m (130 ft) long; overall width – No data; 5.5 m (18 ft) roadway width.	Unlimited vertical; horizontal – No data;	Deck; concrete	Poor	Built in 1908, bridge not recommended for use (dangerous). Permanent bypass has been provided upstream from the bridge.
5	State Highway 1	059572	Railroad spur into Main Post	No data; civilian design of H-20, S-20-12, H20-S16 or HS20.	54.3 m (178 ft) right span and 53.6 (176 ft) left span long; overall width – No data; 15.6 m (51 ft) right span and 16.5 m (54 ft) left span roadway width.	Unlimited vertical; horizontal – No data.	Deck; concrete boxed girder.	Good	Built in 1973; Cal. Dept. of Trans. bridge No. BR 44-201 R and L.
6	State Highway 1	060567	Fort Ord PUC Underpass	No data; civilian design of H-20, S-20-12, H20-S16 or HS20.	5.5 m (18 ft) long; 22 m (72 ft) overall width; roadway width – No data.	Unlimited vertical; horizontal – No data.	Deck; concrete Slab culvert.	No data	First built 1943, last work done in 1973; Cal. Dept. of Trans. bridge No. BR 44-81.
7	State Highway 1	060568	First Street Underpass	No data; civilian design of H-20, S-20-12, H20-S16 or HS20.	12.5 m (41 ft) long; 32.4 m (106 ft) overall width; roadway width – No data.	Unlimited vertical; horizontal – No data.	Deck; concrete boxed girder	No data	Built 1973; Cal. Dept. of Trans. bridge No. BR 44-200

2. RAILROADS

MAP NUMBER	GRID REFERENCE FROM TO	LENGTH OF TRACK OR TRACK SEGMENT	OWNERSHIP AND CONDITION	TRACK AND BED CHARACTERISTICS	SIDINGS LENGTH & GRID COORDINATES FROM TO	BALLAST MATERIAL	TRAFFIC VOLUME AND CAPACITY	FACILITIES GRID COORDINATES
Line 1	039540 – 066598	6.7 km (4.2 mi)	Southern Pacific Railroad Company (private); good condition	Single track, standard gage, 1.44 m (4 ft 8.5 in.); weight of rails 52 kg (115 lb).	1440 m (4725 ft); 058569 – 059584 549 m (1800 ft); 054560 – 057562 411 m (1350 ft); 054560 – 057562 1828 m (6000 ft); 058569 – 064584 1440 m (4725 ft); 060564 – 060566 503m (1650 ft); 059573 – 059578 389 m (1275 ft); 059573 – 059578 274 m (900 ft); 059573 – 059576 160 m (525 ft); 061584 – 064584 366 m (1200 ft); 051557 – 053559	Crushed stone	25-99 cars per month	No data

3. AIRFIELDS

NAME; LOCATION; TYPE; AND CLASSIFICATION	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING, APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
Fritzsche Army Airfield; Grid Reference 107601; Army; Airfield	Elevation: 41 m (134 ft) Status: Operational	Runway: 914 m long; 22.8 m wide (3000 ft long; 75 ft wide). Azimuth: 110° – 290° Weight bearing capacity: SWL 20; AUW50. Surface material and condition: Asphaltic concrete, surface in excellent condition.	Five Taxiways: 366 x 15 m (1200 x 50 ft); 640 x 15 m (2100 x 50 ft); (2) 140 x 15 m (460 x 50 ft); 549 x 15 m (1800 x 50 ft) Asphaltic concrete in excellent condition. Maximum weight bearing capacity same as runway. Parking, Apron and Hardstand Areas: 15 parking pads for rotary wing aircraft, each 38 x 18 m (125 x 60 ft). Parking apron, taxiway and hover point for rotary wing aircraft, totaling 4316.8 m^2 (46,467 ft^2), completed in November 1964. Parking apron, totaling 6183 m^2 (66,559 ft^2) for fixed wing aircraft, consisting of one transient parking apron and three access maintenance aprons to the hangars. Holding apron 955.5 m^2 (10,285 ft^2).	Operations building, 424.3 m^2 (4567 ft^2). Fire and rescue station, 265.4 m^2 (2857 ft^2). Two permanent hangars, both totaling 5341.8 m^2 (57,500 ft^2). Field maintenance hangar, 3251.5 m^2 (35,000 ft^2). Aircraft parts storage, 2550.7 m^2 (27,456 ft^2). Two semi-permanent hangars, both totaling 1185.4 m^2 (12,760 ft^2).	Types of Fuel: 115/145, JP-4 Fuel which contains icing inhibitor. Grades of oil; 1065 (Dispersant); Reciprocating engine oil; 1005, Jet engine oil. Storage and Dispensing Facilities: There are two 10,000 gallon tanks for aviation fuel and two 10,000 gallon tanks for jet fuel.	Control Tower: Height 64 m (211 ft) above sea level. Communications: FSS Salinas SNS-DL NATAM SNS: Monterey App Control; Monterey Dep Control. Instrument Landing System: Radio aids to navigation, radar. Lighting: Rotating light (rotating beacon); high intensity runway lights.	Most facilities at the airfield are of permanent construction since its activation in 1960. The approach zones are clear of obstructions. The pavement is capable of being expanded. Obstructions are one elevated water storage tank, 86 m (281 ft) above sea level and two hangars, 80 m (262 ft), 18 m (58 ft) high. Heliport located at airfield (see Helicopter Landing Zones). Aerodrome is only partially covered by the USAF NOTAM System and maintains a military NOTAM file. (For complete aerodrome information, civil NOTAMS must also be consulted).

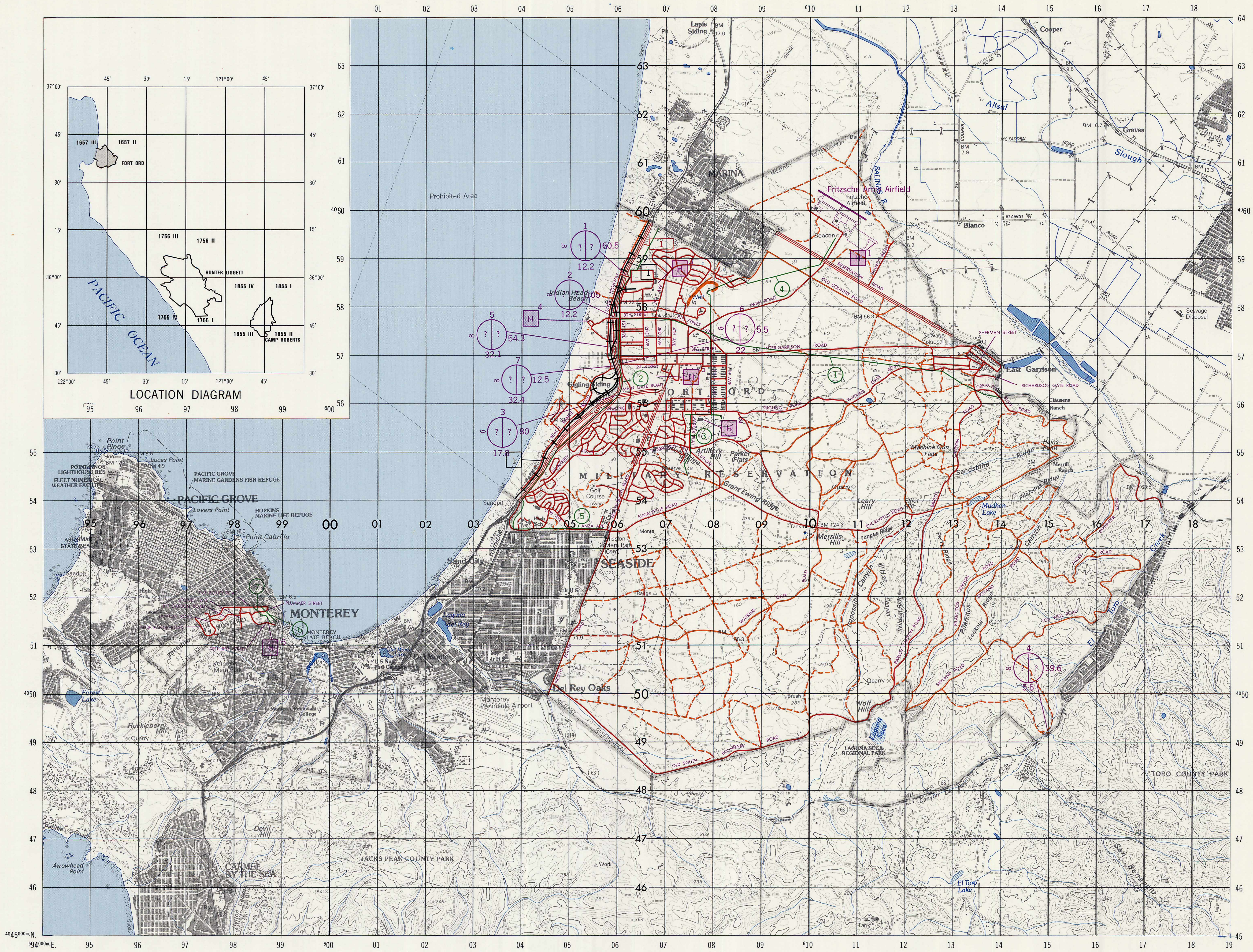
NOTE: Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following SWL and AUW. Runway weight bearing capacity given is for unlimited operations. Aircraft weights higher than given require prior permission from the aerodrome controlling authority.
AUW – All up weight. Maximum weight bearing capacity for any aircraft irrespective of landing gear configuration.
SWL – Single wheel loading. (This includes information submitted in terms of Equivalent Single-wheel Loading (ESWL) and Single Isolated Wheel Loading).

4. PIPELINES

MAP NUMBER	GRID REFERENCE (FROM – TO)	LENGTH OF SEGMENT	OWNERSHIP	PIPE CONSTRUCTION MATERIAL	PIPE SIZE	MATERIAL CARRIED	REMARKS
1	140562 – 061578	8.9 km (5.5 mi)	PG&E	No data	25 cm (10 in)	Natural Gas	Underground pipeline.
2	069597 – 038533	7.1 km (4.4 mi)	PG&E	No data	25 cm (10 in)	Natural Gas	Underground pipeline.
3	079584 – 074545	4.5 km (2.8 mi)	Government	Steel	60 cm (24 in)	Water	Underground pipeline.
4	079584 – 106595	3.0 km (1.9 mi)	Government	Cast Iron	20 cm (8 in)	Water	Underground pipeline to supply the airfield.
5	038534 – 057534	1.8 km (1.1 mi)	PG&E	No data	No data	Natural Gas	Underground pipeline to supply the Roger S. Fitch Jr. High School.
			PIPELINES, PRESIDIO OF MONTEREY				
6	989515 – 986518	0.5 km (0.2 mi)	Calif-AM Water Co	No data	40 cm (16 in)	Water	2 side by side water underground mains.
7	989515 – 984518	0.7 km (0.4 mi)	Calif-AM Water Co	Steel	46 cm (18 in)	Water	Underground pipelines.

5. HELICOPTER LANDING ZONES

MAP NUMBER AND NAME	GRID REFERENCE	DIMENSIONS	AZIMUTH	ELEVATION	SURFACE MATERIAL	RESTRAINTS	REMARKS
1 Fritzsche Army Airfield	113593	45.7 x 45.7 m (150 x 150 ft)	110° – 290°	41 m (134 ft)	Asphaltic concrete	Control tower, 64 m (211 ft) above sea level. Elevated water storage tank 86 m (281 ft) above sea level.	
2 Hays Army Hospital	078556	No data	No data	No data	Concrete	Multistory hospital	Landings on north side of the hospital are not recommended due to overhead wires. This area is lighted for night operations. Can also land in the parking areas to the west of the hospital.
3 North Parade Field	068585	No data	No data	No data	Grass	Flagpole to the north of this site.	Near Post Headquarters.
4 Stilwell Hall	054578	No data	No data	No data	Bituminous	No data	Usually land in the parking lot.
5 Drill Sergeants Parade Field (South Parade Field)	067566	No data	No data	No data	Concrete	No data	
			HELICOPTER LANDING ZONES, PRESIDIO OF MONTEREY				
6 Sloat Monument	986516	No data	No data	No data	Grass	No data	Usually approach from the East.



FORT ORD AND PRESIDIO OF MONTEREY, CALIFORNIA TERRAIN ANALYSIS

Scale 1:50,000

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

LINES OF COMMUNICATION

ROADS

- Hard surface, divided, 4 or more lanes
- Hard surface, 2 or 3 lanes
- Hard surface, 1 lane
- Loose surface, 1 lane
- Improved dirt
- Unimproved dirt
- 1 State route marker

BRIDGE DATA (measurements in meters)

- A Bridge number
- B One-way military load classification
- C Two-way military load classification
- D Roadway width
- E Length
- ∞ Unlimited vertical clearance
- ? No data available

RAILROADS

- 1 Single track, standard gauge and identification number

AIRFIELDS

- Airfield

PIPELINES

- 7 Pipeline and identification number

HELICOPTER LANDING ZONES

- H 6 Landing zone and identification number

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

K. URBAN AREAS (CANTONMENT AREAS)

FORT ORD

TROOP BILLETS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
Permanent with mess	31	5371	Good	Most of these were built in 1952.
Permanent without mess	16	2433	Good	
Temporary	333	11,772	Good	Originally built during WWII as 42 man temporary mobilization-style barracks. Some have been modified as late as 1968, most now house 35 to 36 men. Long range plan is to replace these structures with permanent buildings on the same sites; however, no short falls are foreseen for the near-term future.
Totals	380	19,576		As of 31 August 1977 there were 16,412 military and 11,022 civilians assigned to Fort Ord. However, with support being furnished to Presidio of Monterey and Fort Hunter-Liggett, in total, Fort Ord supports a population of approximately 65,000 including 21,000 active duty military, 20,000 dependents, 23,000 retired military, and 4400 civilian employees.

BACHELOR QUARTERS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
			BACHELOR OFFICER QUARTERS	
Permanent	7	172	Good	Apartment style buildings for male and female officers.
Temporary	16	377	Good	Buildings date from 1940 – 1941. The present stationing plan requires increased units to meet demands. Additional units will not be available in the near future.
Totals	23	549		
			BACHELOR ENLISTED QUARTERS	
Temporary		188 spaces	Good	Long range plan calls for construction of 120-man senior bachelor enlisted quarters. The present stationing plan requires increased units to meet demands. Additional units will not be available in the near future.

FAMILY QUARTERS

TYPE	2 BR	3 BR	4 BR	TOTAL	NUMBER OF BUILDINGS	CONDITION	REMARKS
						OFFICER FAMILY HOUSING	
Senior Grade	0	21	2	23	23	Good	All senior and field grade officers are housed in one-family buildings.
Field Grade	32	120	10	162	162	Good	Family housing is in fair to good condition.
Company Grade	136	298	102	536	319	Good	Company grade officers are housed in 102 one-family and 217 two-family buildings.
Totals	168	439	114	721	504		Additional permanent family housing is required under the present stationing plan. There are two general quarters now under construction at the NE corner of the golf course.
						NCO FAMILY HOUSING	
NCO Grades	726	1434	383	2543	1437	Good	NCO family housing is in 465 one-family, 905 two-family, and 76 four-family buildings. There are 348 NCO Family Housing units now under construction north east of George S. Patton, Jr. Park (64 duplexes, 49 four-plexes, and 8 three-plexes).
Total Family Quarters	894	1873	497	3264	1941		
						TYPE OF FAMILY HOUSING	
Wherry				100 units			
Capehart				2084 units			
MCA				280 units			
Inadequate				800 units			Inadequate refers to many units in good condition which because of limited floor space and personnel ratios are rated inadequate by today's modern housing standards.
TOTAL				3264 units			
						GUEST HOUSING	
Temporary (4 buildings)				212 units		Good	Barracks type buildings built in 1941 and 1943 with 57 apartments (2, 3 and 4 bedrooms) and 155 guest rooms.

UTILITIES

CAPACITY AND CURRENT LOAD	REMARKS
ELECTRIC POWER	
In 1974 the total electrical consumption for Fort Ord Main Garrison, East Garrison, and Fritzsche Army Airfield was 72,218,000 kWh. The maximum demand for these areas was 12,940 kW. Electric power is supplied through 60 kV feeders to the substation on Gigling Road near the permanent barracks area. This substation has 5000 kVA transformers to reduce the power distribution to 12,000 volts. Fans used for forced cooling can increase an additional 25 percent capacity from each transformer. Capacity in kilowatts and maximum power deliverable in kilowatt-hours are 18,000 kW and 18,000 kWh per hour respectively. The 12 kV lines are mounted on 12.2 m (40 ft) poles and the 60 kV feeders are on 19.1 m (62.5 ft) towers. Two substations, No. 1 (Building #4535) and No. 2 (Building #4700) have a 2000 kVA transformer capacity in stepping down the 12 kV voltage to 4 kV. The switching station near the Gigling Road substation consists of five 12 kV circuits with bypass switches. Capehart family housing area is served from the main switching station by a 12 kV feeder direct to pole-mounted transformers. Bay View is served by a 4 kV feeder and North Bay View is served by a 12 kV feeder directly from Pacific Gas and Electric-owned distribution system. Fritzsche Army Airfield is served by a 12 kV feeder from the Main Garrison Main switching station. East Garrison is served directly from Pacific Gas and Electric Transmission along Reservation Road.	Electric power supplied by the Pacific Gas and Electric Company. Fort Ord is served by two high-voltage transmission lines. There are 21 standby power generators from 5 kVA to 50 kVA ratings, serving the Signal Building, Post Headquarters, Radio and Communications Facilities, Hospital, Stockade, and Airfield Facilities. Part of the electricity from the Pacific Gas and Electric Network is generated at Salinas and at the Moss Landing Stream Plant about ten miles north of Fort Ord; Pittsburg Stream Plant on Suisun Bay; Bakersfield Stream Plant in the San Joaquin Valley; and Morro Bay about 160.9 km (100 mi) south of Fort Ord. Fort Ord has completed the upgrading of the 4 kV power system to 12 kV power system with the exception of a small area of about 15 percent. There are no known problems at the present and there are no plans to expand the system, except to accommodate the 350 family units now being constructed. Practical capacity for 1980 will be approximately 93.68 million kWh's per year, which is approximately 60% of the theoretical capacity of 157 million kWh's.
NATURAL GAS	
Pacific Gas and Electric Company 10-inch high pressure gas line extends along 8th Street to 2nd Avenue, where the gas is metered and reduced from 300 psi to 10 psi for distribution in the cantonment area. Pacific Gas and Electric Company 3-inch high pressure gas line extends to the airfield and George S. Patton, Jr. Park housing area, where gas is metered at 15 psi. In the East Garrison area, the pressure reducing station is metered and reduces the high pressure gas line from 300 psi to 5 psi. Maximum deliverable capacity is 23,574,888 therms/annum or 249,178 CF/hour. Peak load used was 1,964,579 therms/month in February 1976. Average yearly consumption is 15,691,704 therms/year or 1,307,642 therms/month.	Natural gas is supplied by Pacific Gas and Electric Company as a primary fuel with standby fuel oil capability. Bay View and North Bay Wherry housing areas are each master metered and the system is owned by the Pacific Gas and Electric Company. All other housing areas and cantonments have government-owned systems which are metered off of seven stations. All family housing units are individually heated. The majority of the cantonment buildings are individually heated by either circulating warm air furnaces, hot water, or space heaters. The heaters and low pressure boilers (40 steam and 76 hot water) are gas fired. There are no known problems at the present and there are no plans to expand the system. In accordance with DA directives, in the future all new buildings will be heated with fuel oil.

UTILITIES (continued)

CAPACITY AND CURRENT LOAD	REMARKS

WATER SUPPLY

Capacity and Current Load

Water sources are eighteen deep wells, and both elevated and ground water storage tanks. The Main Garrison has elevated storage tanks with capacity 1,514,080 liters (400,000 gals) and ground water tanks with capacity of 35,259,138.1 liters (9,315,000 gals). The East Garrison has ground water tanks with capacity 1,514,080 liters (400,000 gals). The Airfield area has elevated storage tank with capacity 1,135,560 liters (300,000 gals).

The current water consumption (Fiscal Year 1974) of the Main Garrison, East Garrison, and Airfield area, was an average of 4.7 million gallons per day. The per capita water consumption averages 617 liters (163 gals) per day.

Maximum deliverable water supply is 61,700,000 liters per day (16 mgd), with the peak usage occuring in April and October amounting to 45,420,000 liters per day (12 mgd).

Existing average water supply is 27,770 liters per minute (7337 gpm) or 26,657,800 liters per day (7 mgd).

Remarks

All water produced is chlorinated.

Fluoridation facilities are provided for the Main Garrison distribution system.

In 1975 the Corps of Engineers, Sacramento District, recommended the eastablishment of a new well field in the Salinas Valley area between the airfield and East Garrison. They proposed eight new wells spaced 804.7 m (0.5 mi) apart which they thought could deliver 7570 liters per minute (2000 gpm) or about 7,570,000 liters per day (2 mgd) each during a 16 hour day. This recommendation was based on an estimated ultimate maximum daily use of 60,560,000 liters per day (16 mgd) for a future full time resident population of 44,000. To date no money has been appropriated for this purpose.

SEWERAGE

Capacity and Current Load

Fort Ord has its own system, a remodeled secondary treatment plant with a design capacity of 15,897,000 liters per day (4.2 million gallons daily).

Average daily load is 15,102,200 liters per day (3.99 mgd), with a peak load of 29,368 liters per minute (7759 gpm).

Daily peak loads occur in the morning as personnel are getting ready for work duties and in the afternoon as they arrive home again.

Increased activity would require use of all plant processing facilities or the necessity of a force main into the Main Garrison treatment plant.

The Ord Village treatment plant is abandoned and the sewage previously treated by this plant is now pumped to the Main Garrison Plant.

Remarks

East Garrison sewage system includes both gravity (ce pipe) and force (transite pipe) mains with present flows treated by Doten tanks and discharged into percolation ponds.

Airfield area has independent sewage system, includes both gravity and force mains to sewage treatment facilities consisting of an Imhoff tank and with a capacity of 281,160.8 liters (74,279 gal), barminutor, sludge beds, and evaporation ponds.

A regional waste water treatment plant with a 83,270,000 liter per day (22 mgd) capacity is being developed in order to meet EPA requirements to eliminate potential health hazards from dumping into the local waterways and Monterey Bay. Sewerage from Fort Ord is to be included in this plant. There are no plans to expand the Main Garrison treatment plant.

TELECOMMUNICATIONS

Capacity and Current Load

Eight thousand four hundred (8400) lines are presently (3/75)available at Fort Ord, including 4200 extension telephones.

Automatic dial system with a capacity of 800 lines, of which approximately 560 can be used at one time.

A secure mode Automatic Digital Data (AUTODIN) telephone and telegraph terminal is located in the communication center.

Pacific Telephone and Telegraph Company has 84 incoming and 59 outgoing lines servicing the post.

The Western Union, through government-owned cable facilities,operates teletype equipment for both personal and official telegrams.

Weather service facilities at Fritzsche Army Airfield include a USAF circuit to Tinker Air Force Base, Oklahoma, a Federal Aviation Administration weather teletype circuit to Oakland weather control, California, and one weather facsimile circuit.

Remarks

Television studio located in building #4738.

Television transmitter located in building #4372.

Radio transmitter located next to water reservoir at building #4371.

All telephone facilities are government-owned except for Wherry housing in portions of Joseph W. Stilwell Park and Thomas H. Hayes Park family housing areas.

The telephone cable system requires an additional 1700-line installation to meet future requirements.

Presidio of Monterey is a satellite of the Fort Ord telephone exchange.

SCHOOL FACILITIES

TYPE	CAPACITY	TOTAL ENROLLMENT	SERVICE CONNECTED	REMARKS
ELEMENTARY	Thomas H. Hayes (800 pupils)	463	434	Enrollment figures are as of October 1976. All schools are operated by the Monterey Penisula Unified School District. For small children there is a day-care center, a pre-school, and a nursery. There are no plans to expand these facilities at the present time.
	George C. Marshall (650 pupils)	653	653	
	General George S. Patton, Jr. (900 pupils)	648	575	
	Stilwell (900 pupils)	682	682	
JUNIOR HIGH SCHOOL	Roger S. Fitch (1200 pupils)	1008	861	
HIGH SCHOOL	Seaside (2000 pupils)	1612	872	Located on former reservation land given up for the purpose of the school.
SPECIAL	Gladys Stone School for Mentally Retarded	No data	No data	

MEDICAL FACILITIES

TYPE	CAPACITY	REMARKS
Silas B. Hays Army Hospital	440 beds, can be expanded to 600 beds	Building #4385, built in 1971, containing 34,056 m^2 (366,589 ft^2). There is fixed helipad with lights for night operations.
Dental Clinics	65 chairs	Building #4787, containing 1183.8 m^2 (12,743 ft^2) is a 28 chair structure. Four temporary buildings are also used as dental clinics.
Optometry Clinic		Building #4380, containing 522.7 m^2 (5627 ft^2)
Oral Hygiene Facility		Building #4390, containing 529.3 m^2 (5697 ft^2)
Veterinarian Facility		Building #3144, containing 473.8 m^2 (5100 ft^2)
Temporary Hospital Clinics		Eight buildings of the old hospital complex, scheduled for demolition.
Dispensaries		Three permanent buildings (#4420, #4482, #4573) and eleven temporaries containing 3367 m^2 (36,251 ft^2). These are out-patient facilities without beds.
		There are 103 physicians, 46 dentists, 148 nurses, 500 paramedical personnel, and 619 civilian employees to tend to the health care needs of Fort Ord.
		Planned expansion includes: dispensary at the airfield, 18-chair dental clinic, 2 family practice clinics, veterinary building, new helipad at hospital, mental hygiene clinic, blood donor center, preventive medicine building, oral health evaluation center.

RECREATION FACILITIES

TYPE	NUMBER	REMARKS
Libraries	2 permanent 1 temporary	Additional branch libraries will be developed along with the modernization program.
Gymnasiums	1 permanent 1 temporary	Building #4480 is a permanent 1900.5 m^2 (20,457 ft^2) facility in the southwest part of the new barracks area. Building #2248 is a temporary facility of 2212.2 m^2 (23,813 ft^2) that serves the older portion of the post.
Sports Areas	2	2nd Avenue and 8th Street features boxing ring, courts for basketball, volleyball, squash and handball. The sports arena is supplemented by a new gymnasium near the hospital, plus a facility at the Presidio.
Bowling Centers	1 permanent 1 temporary	Building #3895 is a permanent facility with 1874.7 m^2 (20,180 ft^2) and 24 lanes. Building #177 is a temporary bowling center with 12 lanes.
Indoor Swimming Pool	1	Building #2237 is a permanent facility of 1806 m^2 (19,440 ft^2), it is classed as a 50-meters pool and sauna bath. There is a requirement for four more authorized pools to support the strength.
Theaters	2 permanent 3 temporary	Building #4320 is a permanent theater with stage and 1000 seating capacity. Building #4789 is a permanent theater without stage and a 1000 seating capacity. Building #1061 and #2776 are temporary theaters without stage. Seating capacities are 946 and 970 personnel respectively. Building #92 is a mobilization-type theater in the East Garrison not used at this time.
Multipurpose Courts	6	
Baseball Fields	4	The main field is located south of the 8th Street east of 4th Avenue and includes both bleachers and lighting.
Softball Fields	8	One has permanent lighting.
Football Field	1	This facility includes stadium-type seating and lighting. The field could be modified to include a 440-yard running track.
Golf Courses (18-hole)	2	The two golf courses use the same clubhouse facilities. Driving range is included between the two courses.
Tennis Courts	7	
Handball and Badminiton Courts		Temporary facilities are numerous.
Skill Development Centers	5 Temporary	
Skeet Field	1	Four ranges, 8 positions each. This facility is located at the East Garrison.
Fort Ord Flying Club	1	The facility is located at the Fritzche Army Airfield, open daylight hours seven days a week.
Little League Baseball Fields	3	
Basketball Courts	20	
Volleyball Courts	20	
Arts & Crafts Center	1	Building near the intersection of 8th Street and 2nd Avenue.

Future plans call for the building of 4 unit entertainment centers and 4 learning centers in the troop housing area, EM Service Club/library, theater with stage, running track, post music center, and snack bar in community facilities area, and exchange cafeteria, 2 post individual learning centers, physical fitness center, 2 gymnasiums with pools, 3 athletic facility complexes, 2 indoor pools, recreational auto shop, running track, golf clubhouse, skill development center, bowling center number 2, horse riding facility, rod and gun club, 4 skeet ranges, softball fields, 2 outdoor recreation complexes, regional park, skeet/trap range.

Scheduled expansion plans are behind the original time table, and most of these will not be finished until sometime in the 1980's.

PRESIDO OF MONTEREY

TROOP BILLETS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
Permanent	4	1720	Good	Three with mess and 1 without mess. These are the student dorms for the Defense Language Institute.
Temporary	5	166	Good	All without mess.
Totals	9	1886		End of FY 75 full time assigned strength was 2498 military, 802 civilian, and 30 contractor, for a total of 3330 personnel; of these, there were 945 instructors and an average annual of 2184 students at the Defense Language Institute. A general instruction facility is scheduled for FY 80. When complete, the conversion of some present education facilities to barracks would allow for a 50% expansion of the DLI student personnel.

BACHELOR QUARTERS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
			BACHELOR OFFICER QUARTERS	
Permanent	2	70	Good	Two of these units in building #218 are for female officers. A new BOQ for 81 men is planned for Sargent Bean Road; this will replace the temporary building.
Semi-permanent	4	19	Good	
Temporary	1	33	Good	
Totals	7	122		
			BACHELOR ENLISTED QUARTERS	
			None	

FAMILY QUARTERS

TYPE	NUMBER FAMILY UNITS 2 BR	3 BR	4 BR	TOTAL	NUMBER OF BUILDINGS	CONDITION	REMARKS
						OFFICER FAMILY HOUSING	
Senior Grade	0	7	13	20	20	Good	All senior officers are housed in one-family buildings. Four field grade families are housed in 2 two-family buildings.
Field Grade	0	7	5	12	10	Good	
Company Grade	5	0	0	5	5	Good	
Totals	5	14	18	37	35		
						NCO FAMILY HOUSING	
NCO Grades	16	30	10	56	17	Good	NCO family housing is in 2 one-family, 5 two-family, 8 four-family, and 2 six-family buildings.
Total Family Quarters	21	44	28	93	52		
						TYPE OF FAMILY HOUSING	
MCA			50 units				Future plans call for an increase to 233 family housing units. 80 duplex family units have been planned.
Other Public Quarters			43 units				
Total			93 units				
						GUEST HOUSING	
2 small cottages with one unit each							A future 958 m^2 (10,400 ft.^{2}) structure is planned.

K. URBAN AREAS (CANTONMENT AREAS) (CONTINUED)

UTILITIES

CAPACITY AND CURRENT LOAD	REMARKS
ELECTRIC POWER	
Primary distribution is by three-phase, 60-cycle, four-wire lines at 4160 volts. There are 66 transformers with a total transformation of 2970 KVA. Substation has a 2500 KVA transformer which reduces voltage from the 21,000 volt feeders to the 4160 volts. Electrical consumption for peak year was 6,705,600 KWH; average annual consumption amounts to 5,797,000 KWH. Average monthly power consumption in 1974 was 483,083 KWH. Capacity in KW and maximum power deliverable in KWH are 2500 KW and 2500 KWH per hour respectively.	Electric power supplied by the Pacific Gas and Electric Company. Power is generated by several fossil fuel plants. A nuclear power plant is planned for the future.
NATURAL GAS	
Pressure main into the post meter reduces incoming gas pressure from 60 psi to 5 and 10 psi. Average annual consumption is 1,278,295 therms per year or 106,527 therms/month. Peak load amounts to 160,000 therms/month. System capacity amounts to 1,742,424 therms/month or 224,070 CF/hour. Purchases of heating supplies in 1974 amounted to: Fuel oil - 14,467 gals Natural gas (firm supply) - 887,750 therms Natural gas (interruptable supply) - 466,500 therms	Natural Gas is supplied by Pacific Gas and Electric Company. It is the primary fuel used for heating. Heating fuel oil is held as a reserve at some heating plants. Over the past few years there have been no major problems with the present system and no expansion of the system is planned. Two 10-inch mains and one 4-inch main supply natural gas to the Presidio. In the future, in accordance with DA directives against future natural gas usage, fuel oil will be used.
WATER SUPPLY	
One concrete water storage tank of 748,000 liter (200,000 gal) storage capacity. Four booster station pumps rated respectively at 1138, 748, 1138, and 378 liters per minute (300, 200, 300, 100 gpm). The four 4-inch compound Rockwell meters have a maximum flow rating of 1892 liters per minute (500 gpm) each. Therefore, maximum deliverable is 2,725,000 liters per day (720,000 gpd). Current consumption is 643,450 liters per day (170,000 gpd), with an average per capital consumption of 170 liters per day (45 gpd) and a peak usage of 946,250 liters per day (250,000 gpd). The above figures are for 1977, during which severe conservation restrictions have been placed on water usage. Prior to 1977 water usage was much higher: 314 liters per day per capita (83 gpd per capita) and 29,318,924 liters per month (7,746,083 gallons per month.)	The California-American Water Company sells water to the post from its wells in Carmel Valley. Water comes onto the post from a 12-inch main with 40-50 psi on Rifle Range Road and an 8-inch main with 70-80 psi on Kit Carson Road. Each of these metered with 2 compound Rockwell meters. From these meters, distribution is through 2 government-owned systems of 3-, 4-, 6-, 8-inch mains. No expansion which would increase water use is planned at this time. The present water supply is just adequate to meet the area's water needs. Problems with water supply are expected until a long range solution can be found. The 100 gpm booster pump in building #T625 is owned by the Cal-Am. Water Co. Planned for on-post is a 500,000 gallon reservoir, but there is a question of water availability to fill it. For an average population of 3124 persons, future peak rate demand is estimated at 2983 liters per minute (788 gpm).
SEWERAGE	
The city of Monterey has a treatment plant with a capacity of 17,410,000 liter per day (4.6 mgd). The average flow is 11,350,000 liters per day (3.0 mgd) with short peaks up to 22,710,000 liters per day (6.0 mgd). The Presidio portion of this amounts to an average daily load of 514,760 liters per day (136,000 gpd), with peak load of 757,000 liters per day (200,000 gpd).	The sanitary sewer system is a government-owned system, well maintained. There are no plans for expansion, except as needed for future modification of buildings. Sewage treatment is contracted out to the city of Monterey for an annual fee. The system operates on the gravity feeder principal with no lift stations required. To meet EPA requirements, an 83,270,000 liter (22 mgd) regional sewage treatment plant is scheduled to go into operation by 1981.
TELECOMMUNICATIONS	
A 500-line, automatic 3-digit dial system with a 400-line capacity is located in building #343. The telephone exchange has 10 out, 8 in, and 10 two-way leased lines between Presidio of Monterey and Fort Ord. The system will allow about 60 on-going calls at the same time. Teletype facilities are located in building #277. Radio, TV, and sound recording facilities are located in building #418.	The telephone exchange at the Presidio of Monterey is a satellite of the Fort Ord telephone exchange. The on-post system is government-owned and feeds into the Pacific Telephone and Telegraph Company. There is no Western Union Office at the Presidio. Class B phones are in the process of being reverted back to PT & TC.

SCHOOL FACILITIES

TYPE	NAME	TOTAL ENROLLMENT	SERVICE CONNECTED	REMARKS
Elementary	Larkin Elementary School	293	100	None of these schools are post.
Junior High School	Colton Junior High School	799	260	
High School	Monterey High School	1638	454	

MEDICAL FACILITIES

TYPE	NUMBER	REMARKS
Medical/Dental Clinic	1 Permanent	Building #422, built in 1977, with 24,621 ft^2, 12 dental chairs and 9 doctors.
Dispensaries without Beds	2 Temporary	Both of these are planned for replacement when the new facility becomes fully operational.
		No heliport is planned due to the local air traffic.

RECREATION FACILITIES

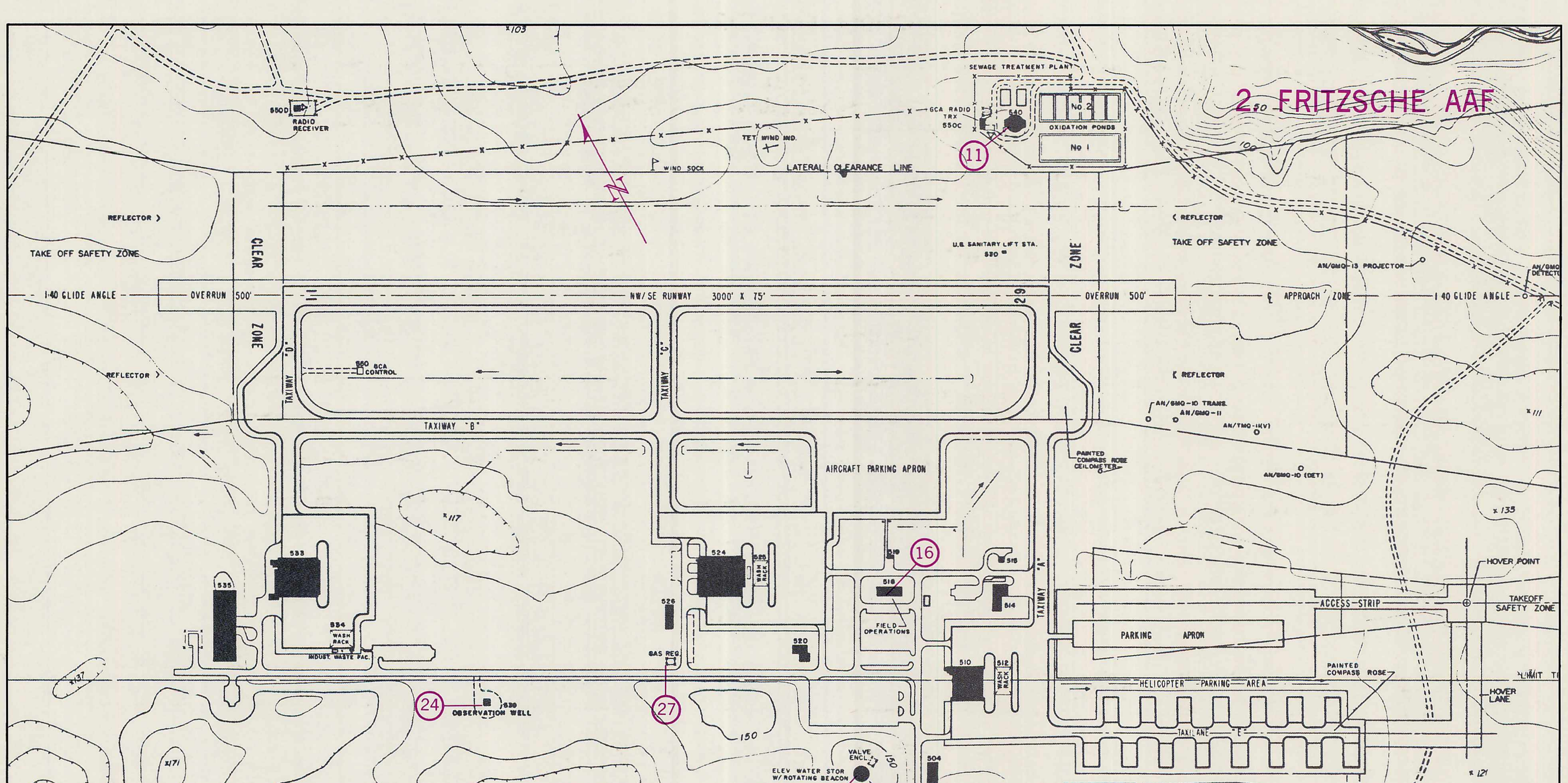
TYPE	NUMBER	REMARKS
Theater	1 Permanent	Building #208, 414.3 m^2 (4460 ft^2), 300 seats, without stage.
Gymnasiums	1 Semi-permanent	Building #228, 1729.8 m^2 (18,620 ft^2).
EM Service Club	1 Semi-permanent	Building #302, 2147.2 m^2 (23,113 ft^2).
Bowling Center	1 Semi-permanent	Building #220, 345 m^2 (3714 ft^2).
Skill Development Center	1 Temporary	Building #141, 505.2 m^2 (5438 ft^2).
Library	1 Temporary	Building #106, 181.2 m^2 (1950 ft^2).
Academic Library	1 Permanent	1021.9 m^2 (11,000 ft^2), planned for 1981.
Athletic Facilities	? Permanent	Planned for 1981.
Auditorium and Theater	1 Permanent	1950.9 m^2 (21,000 ft^2), planned for 1981.
Recreation Workshop	1 Permanent	1031.2 m^2 (11,100 ft^2), planned for 1982.
Youth Center	1 Temporary	Building #454, 282 m^2 (3401 ft^2) formerly a fire station.
		A combination permanent gymnasium/recreation facility (hand/squash courts, bowling alley, indoor pool, and bath house) of 4308 m^2 (46,380 ft^2) is planned for construction west of the academic area. A new EM Service Club/Library is also planned.

FORT ORD AND PRESIDIO OF MONTEREY, CALIFORNIA
URBAN AREAS (CANTONMENT AREAS)

Approximate Scale 1:8,400

1000 500 0 1000 2000 Feet

500 0 500 Meters



Approximate Scale 1:5,800

1000 500 0 1000 2000 Feet

500 0 500 Meters

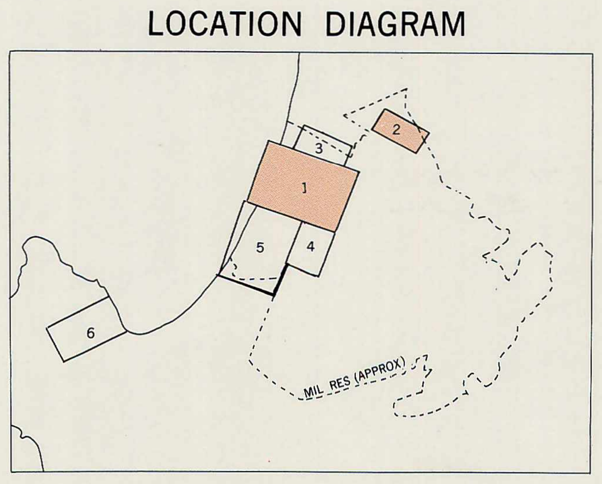
AREA FEATURES

- Barracks, Troop Quarters
- Guest Houses
- Parade Ground
- Recreation Facilities

SITE FEATURES

1. Headquarters
2. Post Hospital
4. Post Exchange
6. Post Office
9. Post Engineers (DFAE)
11. Sewage Treatment Plant
12. Electric Power Substation
15. Post Stockade
16. Field Operations (Airfield)
17. Water Treatment Plant
18. Fire Station
20. Visitor Info Center
21. Chapel
22. Indoor Recreation
23. Health Facility
24. Water Facility
25. Snack Bar
26. Service Station
27. Gas/Electric Facility
30. Television Studio
32. Radio Transmitter
34. Community Service Center
35. Flight Obstructions (> 4 Stories)

LOCATION DIAGRAM



1. Main Post
2. Fritzsche AAF
3. Patton Park
4. Marshall and Fitch Parks
5. Stilwell and Hayes Parks
6. Presidio of Monterey

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

FORT ORD AND PRESIDIO OF MONTEREY, CALIFORNIA
URBAN AREAS (CANTONMENT AREAS) (Continued)

AREA FEATURES

- Family Housing, Officers
- Family Housing, NCO
- Barracks, Troop Quarters
- Bachelor Officers Quarters Male/Female
- Outdoor Recreation Facility

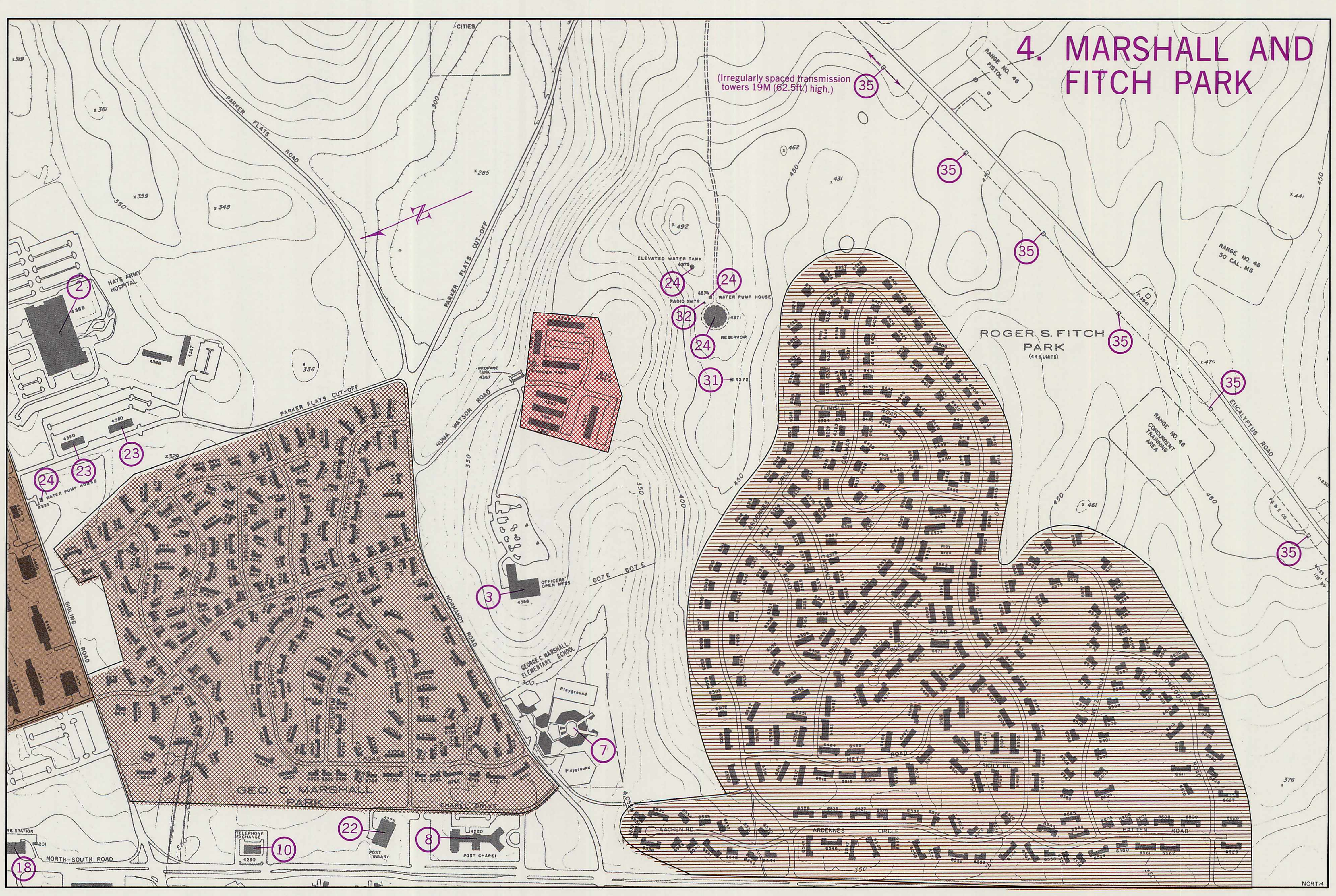
SITE FEATURES

1. Post Headquarters
2. Post Hospital
3. Officer's Open Mess
7. Elementary School
8. Main Post Chapel
10. Telephone Exchange
17. Water Treatment Plant
18. Fire Station
22. Indoor Recreation
23. Health Facility
24. Water Facility
31. TV Transmitter
32. Radio Transmitter
34. Community Service Center
35. Flight Obstructions (>4 Stories)

Approximate Scale 1:7,500

1000 500 0 1000 2000 Feet

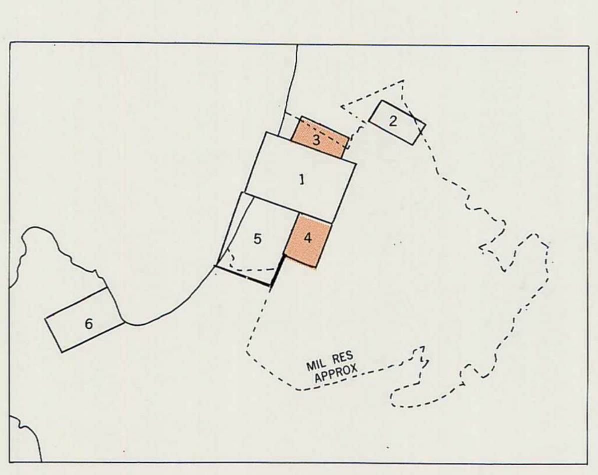
500 0 500 Meters



Approximate Scale 1:7,200

1000 500 0 1000 2000 Feet

500 0 500 Meters



1. Main Post
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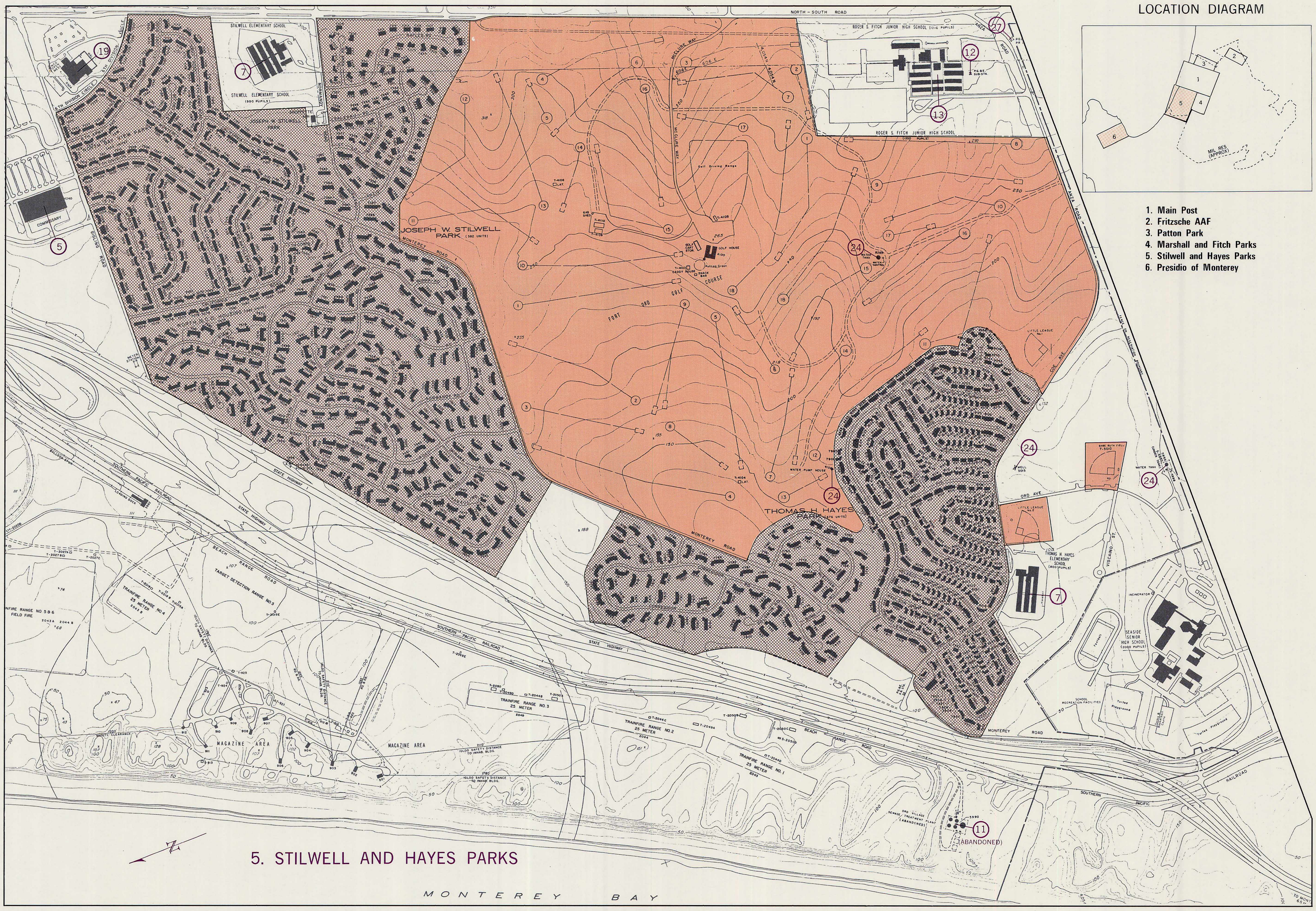
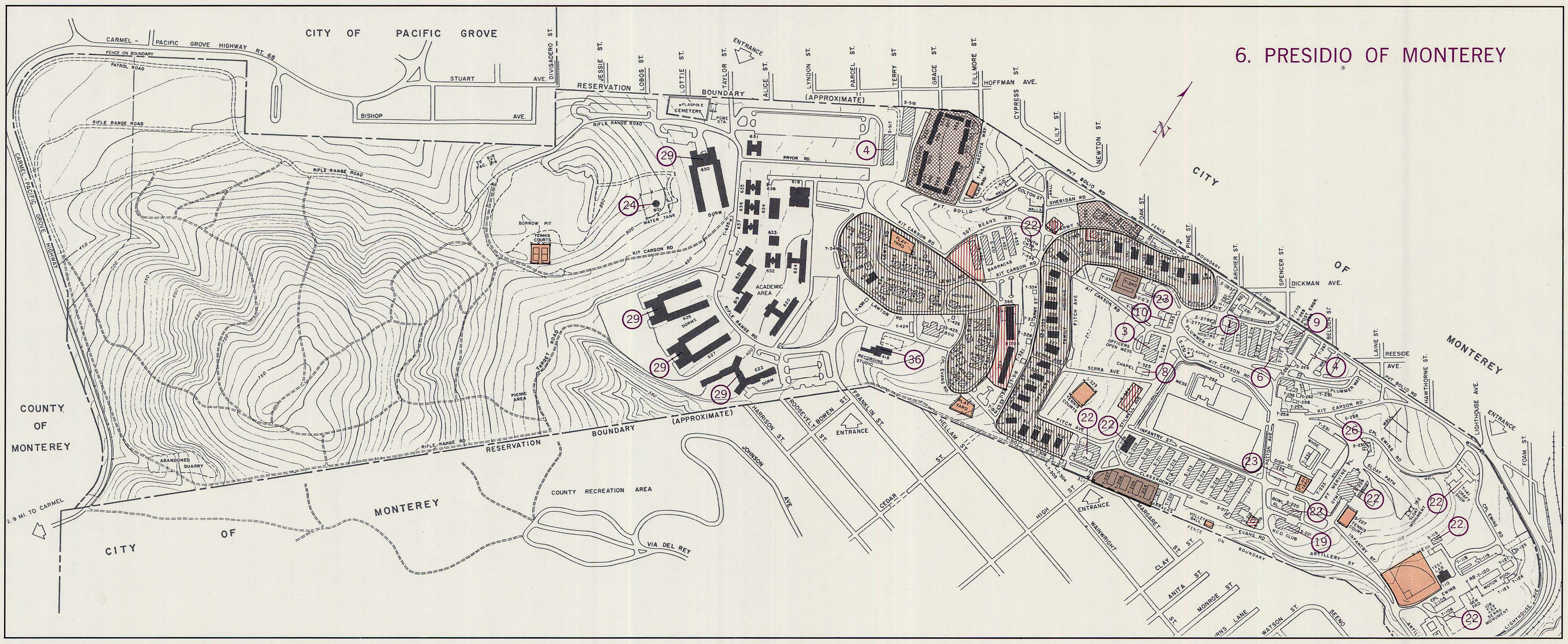
Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

FORT ORD AND PRESIDIO OF MONTEREY, CALIFORNIA

URBAN AREAS (CANTONMENT AREAS) Continued



Approximate Scale 1:7,300



Approximate Scale 1:6,000

SITE FEATURES

1 Post Headquarters
3 Officer's Open Mess
4 Post Exchange
5 Commissary
6 Post Office
7 Elementary School
8 Main Post Chapel
9 Post Engineers (DFAE)
10 Telephone Exchange
11 Sewage Treatment Plant
12 Electric Power Substation
13 Junior High School
19 NCO Club
22 Indoor Recreation
23 Health Facility
24 Water Facility
26 Service Station
27 Gas/Electric Facility
29 Student Dorms
36 TV, Radio and Sound Recording Facility

AREA FEATURES

- Family Housing, Officers
- Family Housing, NCO
- Barracks, Troop Quarters
- Bachelor Officers Quarters, Female
- Recreation Facilities
- Bachelor Officers Quarters, Male

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

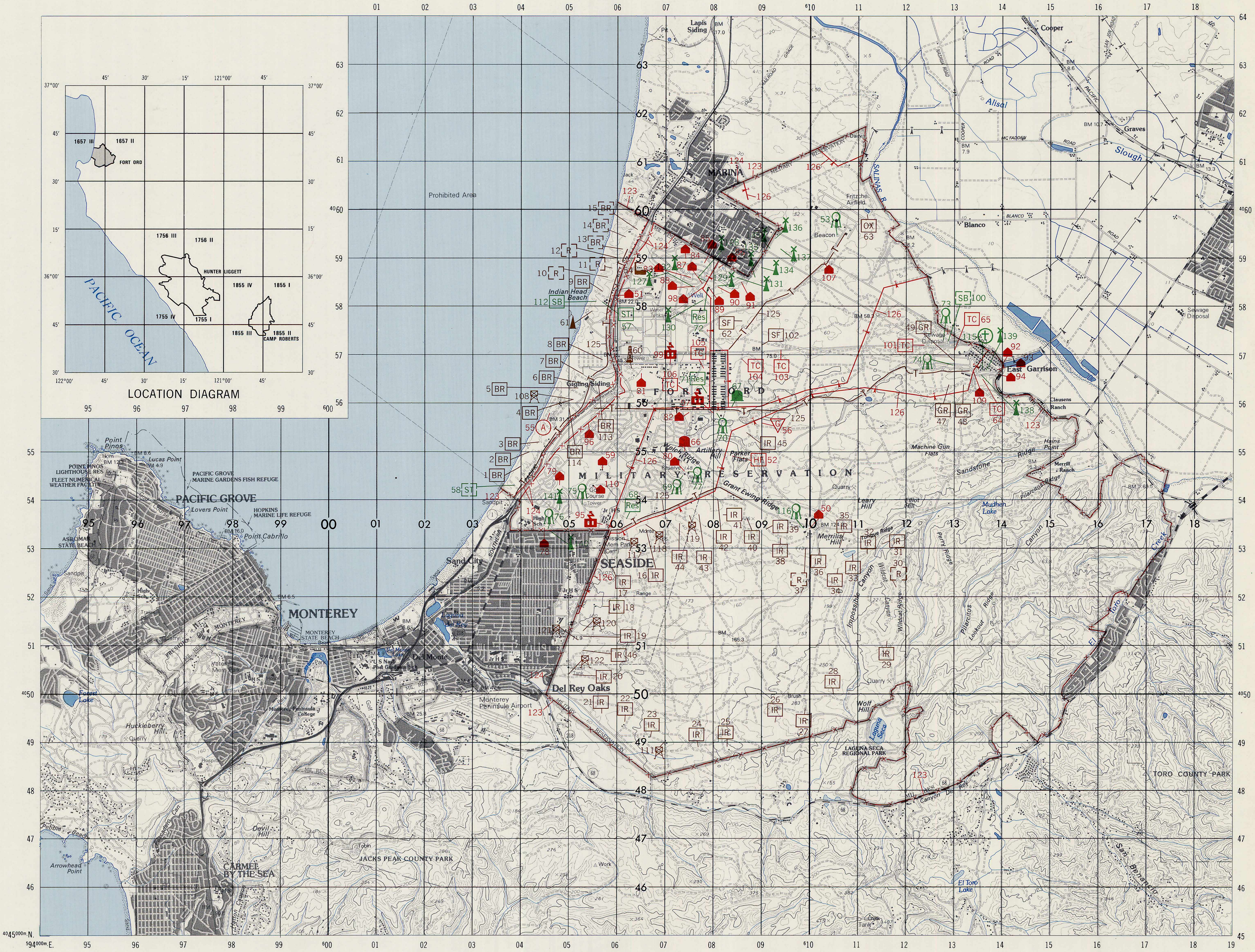
L. NON-URBAN CULTURE FEATURES

On the Fort Ord Reservation, there are over 141 man-made features outside the cantonment area which could affect military training or operations either positively or negatively. Most of the features, depicted on the accompanying map and described below, consist of buildings, water tanks and range towers. The described features included are those that existed as of September 1976.

MAP NUMBER	GRID REFERENCE	DESCRIPTION
1	040547	Beach Range, M16 Zero-in, rifle teams only
2	042550	Beach Range, M16 Zero-in, rifle teams only
3	044550	Beach Range, M16 Zero-in, rifle teams only
4	051561	Beach Range, M16 Zero-in, rifle teams only
5	052563	Beach Range, Field Firing, M16, pop-ups
6	053564	Beach Range, Field Firing, M16, pop-ups
7	053566	Beach Range, M16, Zero-in
8	057569	Beach Range, Known Distance
9	057583	Beach Range, Zero-in
10	058586	Beach Range, inactive
11	059588	Beach Range, inactive
12	060590	Beach Range, inactive
13	061592	Beach Range, Field Firing, inactive
14	062594	Beach Range, Field Firing, inactive
15	064596	Beach Range, inactive
16	066534	Inland Range, Rifle-Record
17	059526	Inland Range, Rifle-Record
18	057518	Inland Range
19	053512	Inland Range, Transition Range
20	051504	Inland Range, Automatic Rifle-Field
21	057496	Inland Range, Offensive Overhead Range
22	062494	Inland Range, Machinegun-Transition and Field Firing
23	067491	Inland Range, Close Combat Course
24	077489	Inland Range, Machinegun
25	083489	Inland Range, Squad Day/Night Defense
26	093494	Inland Range, Machinegun Assault Range
27	099497	Inland Range, Technique of Fire
28	105500	Inland Range, Platoon Attack Course
29	116511	Inland Range, Day/Night Combat Course
30	118522	Range, inactive
31	115531	Inland Range, Demolition/Explosive Ordnance Disposal
32	112529	Inland Range, Quick Kill
33	109529	Inland Range, Grenade
34	106526	Inland Range, Rifle Night Record Quick Kill
35	106530	Inland Range, Rifle
36	102530	Inland Range, Beach Rest Range
37	099530	Range, inactive
38	094532	Inland Range, Moving Target
39	091534	Inland Range, Mortar
40	087536	Inland Range, Mortar
41	082537	Inland Range, Service Firing
42	081540	Inland Range, Grenade Launcher
43	077537	Inland Range, Pistol
44	073535	Inland Range, Machinegun Weapons Demonstration
45	087554	Inland Range, Landmine Warfare Demonstrations
46	053509	Inland Range, Squad Attack
47	129564	East Garrison Range, Smalll Bore Rifle Range
48	132564	East Garrison Range, Pistol
49	130569	East Garrison Range, Skeet
50	100534	Inland Range, Hq, Bldg #T-819
51	059582	Beach Range Hq, Bldg #2066
52	084549	Helicopter Field Training Area
53	106595	Water Tank, elevated, steel, 1,000,000 liter (300,000 gal) capacity
54	068588	Incinerator
55	046558	Ammunition Storage Site: eight magazines (igloo), each 149.4 m^2 (1607 ft^2); four general purpose magazines, 100.2 m^2 (1078 ft^2); two ammunition huts, one 371.8 m^2 (4000 ft^2), the other 46.8 m^2 (504 ft^2); one general storehouse 37.2 m^2 (400 ft^2); one administration building 37.2 m^2 (400 ft^2)
56	090556	Gas Chamber
57	057581	Sewage Treatment Plant, Government-owned, design capacity of 16,000,000 liters (4,200,000 gal) daily
58	039543	Sewage Treatment Plant, (abandoned)
59	057546	Two General Purpose Warehouses; 347.4 m^2 (3673 ft^2), 371.8 m^2 (4000 ft^2)
60	063567	Rappelling Tower, height 9 m (30 ft)
61	055579	Radar Site
62	086577	Sanitary Fill
63	112599	Oxidation Pond
64	136565	Leaders Reaction Course
65	130571	Heavy Vehicle Precision Driving Course
66	074550	Propane Tank
67	084559	Fuel Oil Storage Tank, storage capacity 1,000,000 liters (275,000 gal)
68	062536	Ground Water Reservoir, open, concrete, storage capacity 7,600,000 liters (2,000,000 gal)

MAP NUMBER	GRID REFERENCE	DESCRIPTION
69	074545	Water Tank, storage capacity 7,600,000 liters (2,000,000 gal), height 7.6 m (25 ft^2)
70	081558	Water Tank, storage capacity 7,600,000 liters (2,000,000 gal), height 7.6 m (25 ft^2)
71	079562	Ground Water Reservoir, open, concrete, storage capacity 8,000,000 liters (2,115,000 gal)
72	079584	Ground Water Reservoir, covered, concrete, storage capacity 3,800,000 liters (1,000,000 gal)
73	128573	Water Tank, wood, storage capacity 7,600,000 liters (2,000,000 gal), height 9.1 m (30 ft)
74	130568	Water Tank, concrete, storage capacity 7,600,000 liters (2,000,000 gal), height 7.6 m (25 ft)
75	053539	Water Tank, concrete, storage capacity 760,000 liters (200,000 gal), height 12.2 m (40 ft)
76	046534	Water Tank, wood, storage capacity 540,000 liters (150,000 gal), height 15.2 m (50 ft)
77	075546	Water Tank, steel, storage capacity 950,000 liters (250,000 gal) height 18.3 m (60 ft)
78	045534	Water Pumping Station, one pump 1200 liters per minute (315 gpm) capacity, Bldg #5-5998, inactive
79	048543	Water Pumping Station, one pump 1900 liters per minute (500 gpm) capacity, Bldg #4108
80	074546	Water Pumping Station, two pumps 950 liters per minute (250 gpm) capacity, Bldg #4374
81	065566	Water Pumping Station, one pump 2300 liters per minute (600 gpm) capacity, Bldg #3862
82	075558	Water Pumping Station, 14,000 liters per minute (3700 gpm) capacity, Bldg #4395
83	075586	Water Pumping Station, 3400 liters per minute (900 gpm) capacity, Bldg #6000
84	074590	Water Pumping Station, 3800 liters per minute (1000 gpm) capacity, Bldg #6020
85	078589	Water Pumping Station, Bldg #T-3200
86	081588	Water Pumping Station, 2500 liters per minute (650 gpm) capacity, Bldg #3230
87	078585	Water Pumping Station, 2500 liters per minute (650 gpm) capacity, Bldg #T-3190
88	076584	Water Pumping Station, 1500 liters per minute (400 gpm) capacity, Bldg #T-3180
89	079584	Water Pumping Station, 1900 liters per minute (500 gpm) capacity, Bldg #4970
90	081584	Water Pumping Station, 2800 liters per minute (750 gpm) capacity, Bldg #6054
91	086585	Water Pumping Station, 3400 liters per minute (900 gpm) capacity, Bldg #6120
92	140568	Water Pumping Station, 1100 liters per minute (300 gpm) capacity, Bldg #T-64
93	139567	Water Pumping Station, inactive Bldg #T-68
94	139566	Water Pumping Station, 760 liters per minute (200 gpm) capacity, Bldg #T-67
95	057535	Electric Substation, Pacific Gas and Electric Company
96	054556	Sewage Pump Station
97	080558	Electric Substation, Pacific Gas and Electric Company
98	078584	Main Water Booster Pumping Station; 62,000 liters per minute (16,300 gpm) capacity, Bldg #4974
99	071568	Electric Substation, Pacific Gas and Electric Company
100	129573	Sludge Beds, (abandoned)
101	124572	Obstacle Course
102	090572	Sanitary Fill
103	094571	Obstacle Course
104	086569	Confidence Course
105	078567	Infiltration Course
106	075562	Bayonet Training Area
107	103589	Sentry Station, single story, 4.5 m^2 (48 ft^2)
108	051561	Range Tower, height 4 m (13 ft)
109	134567	Rod and Gun Club Building; 249.8 m^2 (2688 ft^2)
110	055543	Golf Club Building, 680.6 m^2 (7323 ft^2)
111	070490	Range Tower, height 10.7 m (35 ft)
112	056581	Sludge Beds
113	056564	Target Detection Range
114	050559	Target Detection Range
115	136567	Whitcher Family Cemetery
116	099534	Water Tank; elevated
117	061532	Range Tower, height 11.6 m (38 ft)
118	066535	Range Tower, height 4 m (13 ft)
119	075537	Range Tower, height 4 m (13 ft)
120	053513	Range Tower, height 4 m (13 ft)
121	052511	Range Tower, height 4 m (13 ft)
122	050504	Range Tower, height 4 m (13 ft)
123	From 045500 To 087606 From 036543 To 039541 From 060601 To 066598	Fence, 3 segments, barbed wire, approximate height 1.2 m (4 ft)

MAP NUMBER	GRID REFERENCE	DESCRIPTION
124		Fence, chain link, approximate height 2.4 m (8 ft)
	From 066598 To 039541	
	From 087606 To 045500	
		Together fences 123T and 124T enclose the entire installation, except for the State Highway 1 right-of-way.
125		Undergound Telephone Cables
	From 039541 To 048555	25 pairs of cables
	From 048555 To 058578	50 pairs of cables
	From 058578 To 062592	25 pairs of cables
	From 083559 To 133567	200 pairs of cables
	From 107595 To 083571	100 pairs of cables
	From 083559 To 067558	1212 pairs of cables
	From 067558 To 055559	600 pairs of cables
	From 086540 To 057529	50 pairs of cables
126		Electric Power lines;
	From 058534 To 124586	60 kv; spacing between poles not able to be determined, height (no data)
	From 051516 To 137571	12 kv; spacing between poles not able to be determined, height (no data)
	From 102613 To 111612	12 kv; spacing between poles not able to be determined, height (no data)
	From 079559 To 079571	12 kv; spacing between poles not able to be determined, height (no data)
	From 083559 To 079571	12 kv; spacing between poles not able to be determined, height (no data)
	From 079571 To 081589	12 kv; spacing between poles not able to be determined, height (no data)
	From 087602 To 086606	12 kv; spacing between poles not able to be determined, height (no data)
127	076584	Water Well 11, maximum daily capacity 2,180,000 liters (576,000 gal)
128	079585	Water Well 14, maximum daily capacity 3,543,000 liters (936,000 gal)
129	081584	Water Well 18, maximum daily capacity 4,088,000 liters (1,080,000 gal)
130	078581	Water Well 19, maximum daily capacity 2,725,000 liters (720,000 gal)
131	085586	Water Well 21, maximum daily capacity 4,906,000 liters (1,296,000 gal)
132	074588	Water Well 23, maximum daily capacity 5,069,000 liters (1,339,000 gal)
133	089586	Water Well 24, maximum daily capacity 4,906,000 liters (1,296,000 gal)
134	090588	Water Well 25, maximum daily capacity 4,906,000 liters (1,296,000 gal)
135	092592	Water Well 26, maximum daily capacity 4,906,000 liters (1,296,000 gal)
136	093594	Water Well 27, maximum daily capacity 1,393,000 liters (368,000 gal)
137	094592	Water Well 28, maximum daily capacity 1,393,000 liters (368,000 gal)
138	136566	Water Well 3, maximum daily capacity 1,553,000 liters (410,000 gal)
139	137567	Water Well 17, maximum daily capacity 1,919,000 liters (507,000 gal)
140	046534	Water Well 0V1, maximum daily capacity 1,717,000 liters (454,000 gal), non-drinking water used for irrigation
141	048538	Water Well at golf course, maximum daily capacity 2,180,000 liters (576,000 gal), non-drinking water used for the golf course



FORT ORD, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

NON-URBAN CULTURE FEATURES

- BR Beach Range
- IR Inland Range
- GR Garrison Range
- R Inactive Range
- Building
- HF Helicopter Field (Training)
- Water tank
- Incinerator
- A Ammo Storage Site (Igloo)
- G Gas Chamber
- ST Sewage Treatment Plant
- Tower
- Radar Site
- SF Sanitary Fill
- OX Oxidation Pond
- TC Training Course
- Propane Tank
- Fuel Oil Storage Tank
- Res Reservoir
- Electric Substation
- SB Sludge Beds
- Cemetery
- Fence
- Electric Power Lines
- Water Wells
- Range Tower
- T Telephone Cables (Underground)

NOTE: Number on map refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

III. OFF-POST FEATURES

Off-Post Features covered by this study include airfields and urban areas within a 50-mile radius of Fort Ord and ports within a 100-mile radius. Detailed information for each topic is depicted in the text and on the graphic which follows.

AIRFIELDS: There are two airfields within a 50-mile radius of Fort Ord that have the capability of handling cargo-troop transport aircraft equivalent to the C-130 Hercules or larger. Detailed information concerning each of the airfields is provided in Table III A. San Jose Municipal Airport, located 80.5 km (50 miles) north of the reservation is accessible by both federal highway 101 and rail. Monterey Peninsula Airport, 4.8 km (3 miles) southwest is easily accessible by state highway 68.

URBAN AREAS: The 28 urban areas considered in this study has a population greater than 2500. The range of population varies from 2575 to 535,000. Twenty-two of the urban areas are incorporated, while the remaining six are not. Table III B provides data for the individual cities.

PORTS: Selected data for the major ports are provided in Table III C. All ports in this study are capable of handling deep-draft ocean going vessels and have troop and equipment transport capabilities.

A. AIRFIELDS

NAMES; LOCATION; TYPE; AND CLASSIFICATION	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
NAME: San Jose Municipal LOCATION: 37°21'39"N, 121°55'39"W TYPE: Civil CLASSIFICATION: Airfield	ELEVATIONS: Runway 17 m (56 ft) STATUS: Operational	LONGEST RUNWAY: 2713 m (8900 ft) long; 46 m (150 ft) wide; azimuth, 120°R – 300°L; weight bearing capacity–S200,T200,ST175, TT300; asphaltic concrete surface in good condition. OTHER RUNWAYS: Azimuths 120°L – 300°R and 110° – 290°; Length unknown.	TAXIWAYS: Widths unknown; surface material-concrete/asphalt; weight bearing capacity–TT300 for each. PARKING APRONS, AND HARDSTAND AREAS: No data	HANGARS: No data MAINTENANCE FACILITIES: No data	TYPE OF FUEL: Commerical aviation fuel 80/87, 100/130, jet fuel *ASTM type A.	COMMUNICATIONS AND NAVIGATION: Control tower, Flight Service Station Oakland, Distance Measuring Equipment (DME), precision approach radar, Instrument Landing System (ILS). LIGHTING: Rotating beacon, runway or strip lights, high intensity runway lights, high intensity approach lights, sequenced flashing lights, visual approach slope indicator systems.	Major airframe and frame powerplant repairs. Aircraft are requested in the interest of noise abatement not to take off or land between 2400 – 0600 unless justifiable.
NAME: Monterey Peninsula LOCATION: 36°35'17"N, 121°50'52"W TYPE: Civil CLASSIFICATION: Airfield	ELEVATIONS: Runway 74 m (244 ft) STATUS: Operational	LONGEST RUNWAY: 2012 m (6600 ft) long; 46 m (150 ft) wide; azimuth 100° – 280°; weight bearing capacity–S-100, T-160, ST175, TT300; asphalt surface in good condition. OTHER RUNWAYS: 1219 m (4000 ft) long; 46 m (150 ft) wide; azimuth 060° – 240°; weight bearing capacity, same as for longest runway; asphalt surface in good condition.	TAXIWAYS: 3,2 with widths of 23 m (75 ft), and 1 15 m (50 ft); surface material–asphalt surface; weight bearing capacity–TT300 for each. PARKING APRONS, AND HARDSTAND AREAS: Total area approximately 110,458 m^2 (1,189,000 ft^2); weight bearing capacity–TT300, concrete and asphalt surface material.	TERMINAL BUILDING: One, 83.8 x 33.5 m (275 x 110 ft); concrete construction HANGARS: 6 dimensions: 23 x 38 m (75 x 125 ft); 27 x 38 m (90 x 125 ft); 23 x 38 m (75 x 125 ft); 31 x 42 m (101 x 138 ft); 28 x 47 m (91 x 155 ft); 17 x 36 m (55 x 118 ft)	TYPE OF FUEL: Commerical aviation fuel 80/87, 100/300, 115/145, jet fuel *ASTM type A.	COMMUNICATION AND NAVIGATION: Control tower, Flight Service Station Salinas, scheduled weather broadcast combination VOR and TACAN (UHF navigational facility – omnidirectional course and distance information), airport surveillance radar, Instrument Landing System (ILS). LIGHTING: Rotating beacon, runway or strip lights, high intensity runway lights, high intensity approach lights, sequenced flashing lights, Runway End Identifier Lights (REIL) (Threshold Strobe Lights).	Prior notification requested for military aircraft due to limited parking facilities. Major airframe and major powerplant repairs. For complete aerodrome information, civil NOTAMS must also be consulted.

Note: Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figures following S, T, ST, TT. Runway weight bearing capacity given is for unlimited operations. Aircraft weights higher than given require prior permission from the aerodome controlling authority.
S – Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F100), etc.
T – Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A), etc.
ST – Runway weight bearing capacity for aircraft with single-tandem landing gear (C-130).
TT – Runway weight bearing capacity for aircraft with twin-tandem type (include quadricycle) landing gear. (B-52, C-135), etc.

For further information, see DOD Flight Information Publication (enroute) IFR-Supplement United, States.

*ASTM – Commerical jet fuels conform to specifications established by the American Society for Testing Materials.

B. URBAN AREAS

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
APTOS 36°59'N 121°55'W Santa Cruz County, California	CENSUS 1970: 8704 ESTIMATED 1975: 9100 PROJECTED 1980: 11,300 Unincorporated	HOUSES: Total Number: 3869 Number of Rentals: 905 Average Monthly Rent: $160 Percent Rental Vacancies: 4.3% New House Starts: 47 Average Number of Sales Per Year: 36 Average Sale Price: $35,000 APARTMENTS: Total Number: 279 Average Monthly Rent: $205 Average Percent Vacant: 12%	ELEMENTARY SCHOOLS: Number of Schools: 4 Enrollment Capacity: 1943 1975 Enrollment: 1797 1980 Projection: 1840 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 704 1975 Enrollment: 634 1980 Projection: 678 SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 1450 1975 Enrollment: 1280 1980 Projection: 1472 COLLEGES: Number of Schools: 1 5027 Students; Cabrille College	DOCTORS: Total Number: 7 Doctor/Population Ratio: 1:1300 DENTISTS: Total Number: No data	PARKS: 2 ATHLETIC FIELDS: 7 TENNIS COURTS: 13 GOLF COURSES: 2	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil Future Plans: None SEWAGE DISPOSAL: Primary treatment new line to Santa Cruz is under construction. HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Soquel Creek County Water District. Expansion Plans: Plan underway *Flow capacity 1.0 million gallons per day. Actual flow at 900,000 gallons per day.	From Pacific Gas and Electric's integrated system, most power coming from plant at Moss Landing. Existing plant being phased out. Adequacy of service is very good.
BEN LOMOND 37°05'N 122°05'W Santa Cruz County, California	CENSUS 1970: 2793 ESTIMATED 1975: 3637 PROJECTED 1980: 3900 Unicorporated	HOUSES: Total Number: 1612 Number of Rentals: 318 Average Monthly Rent: $140 Percent Rental Vacancies: 4% New House Starts: 19 Average Number of Sales Per Year: 18 Average Sale Price: $25,000 APARTMENTS: Total Number: 21 Average Monthly Rent: $165 Average Percent Vacant: 4.8%	ELEMENTARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 540 1975 Enrollment: 552 1980 Projection: 610 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 570 1975 Enrollment: 527 1980 Projection: 597 SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 950 1975 Enrollment: 902 1980 Projection: 913	DOCTORS: Total Number: 1 Doctor/Population Ratio: 1:3637	PARKS: 2 ATHLETIC FIELDS: 5 TENNIS COURTS: 4 GOLF COURSES: 2 All athletic fields located at the schools.	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil Future Plans: None SEWAGE DISPOSAL: Individual septic tanks. HEATING FUELS: Types Available: Natural gas Expansion Plans: Gas mains to be extended as is practical. WATER SUPPLY: Source: San Lorenzo County Water District. Expansion Plans: Underway	Pacific Gas and Electric integrated system, main plant at Moss Landing

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
CAMPBELL 37°17'N 121°58'W Santa Clara County, California	CENSUS 1970: 23,797 ESTIMATED 1975: 25,108 PROJECTED 1980: 25,000	HOUSES: Total Number: 5028 Number of Rentals: No data Average Monthly Rent: $300 Percent Rental Vacancies: None New House Starts: 28 Average Number of Sales Per Year: No data Average Sale Price: $40,000 APARTMENTS: Total Number: 4171 Average Monthly Rent: $230 Average Percent Vacant: None	ELEMENTARY SCHOOLS: Number of Schools: 17 Enrollment Capacity: 11,760 1975 Enrollment: 9005 1980 Projection: 6484 JR. HIGH SCHOOL: Number of Schools: 2 Enrollment Capacity: No data 1975 Enrollment: No data 1980 Projection: No data SECONDARY SCHOOL: Number of Schools: 1 Enrollment Capacity: 1674 1975 Enrollment: 1755 1980 Projection: 1450 COLLEGES: Number of Schools: 2 22,323 Students Campbell and Saratoga Colleges.	DOCTORS: Total Number: 3 Doctor/Population Ratio: 1:8369 DENTISTS: Total Number: 13 Dentist/Population Ratio: 1:1931 HOSPITAL Total Number: 1 Total Beds: 48 Intensive Care Units: None Coronary Care Units: None Planned Expansion: None	PARKS: 2 ATHLETIC FIELDS: 1 TENNIS COURTS: 13	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam-turbine system Future Plans: None SEWAGE DISPOSAL: 1 Secondary treatment plant.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Wells and state water system. Expansion Plans: New water main in Santa Clara District #4, San Felipe Project, and new Santa Teresa Filter plant. *Flow capacity 160 million gallons per day. Actual flow is about 90 million gallons per day.	Adequacy of service is good; 620 gallons per customer per day.
CAPITOLA 36°58'N 121°58'W Santa Cruz County, California	CENSUS 1970: 5080 ESTIMATED 1975: 7739 PROJECTED 1980: 10,000	HOUSES: Total Number: 2536 Number of Rentals: 975 Average Monthly Rent: $300 Percent Rental Vacancies: 1% New House Starts: No data Average Number of Sales Per Year: No data Average Sale Price: $70,000 APARTMENTS: Total Number: No data Average Monthly Rent: $250 Average Percent Vacant: 4%	ELEMENTARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: 975 1975 Enrollment: 973 1980 Projection: 1100 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: No data 1975 Enrollment: 361 1980 Projection: No data	DOCTORS: Total Number: 7 Doctor/Population Ratio: 1:1106 DENTISTS: Total Number: No data Dentist/Population Ratio: No data	PARKS: 5 ATHLETIC FIELDS: 1	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Oil and natural gas heating steam. Future Plans: None SEWAGE DISPOSAL: Primary; uses plant in Santa Cruz.* HEATING FUELS: Types Available: Natural gas Expansion Plans: More lines to be constructed as needed WATER SUPPLY: Source: Soquel Creek County Water District. Expansion Plans: By 1980, plans For 10.35 million gallons a day, up from present 1.15 mgd. *3.0 million gallons per day capacity flow allotted to Capitola from Santa Cruz plant. Actual flow is not know.	Adequacy of service is very good.
CARMEL 36°33'N 121°55'W Monterey County, California	CENSUS 1970: 4525 ESTIMATED 1975: 4780 PROJECTED 1980: 5035	HOUSES: Total Number: 2657 Number of Rentals: No data Average Monthly Rent: $356 Percent Rental Vacancies: 16.6% New House Starts: 25 Average Number of Sales Per Year: 232 Average Sale Price: $52,500 APARTMENTS: Total Number: 308 Average Monthly Rent: $327 Average Percent Vacant: 1%	ELEMENTARY SCHOOLS: Number of Schools: 3 Enrollment Capacity: No data 1975 Enrollment: 722 1980 Projection: No data COLLEGES: Number of Schools: 1 Number Students unknown.	DOCTORS: Total Number: 10 Doctor/Population Ratio: 1:478 DENTISTS: Total Number: 9 Dentist/Population Ratio: 1:531	PARKS: 3 ATHLETIC FIELDS: 1 TENNIS COURTS: 1	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam turbine generator Future Plans: None SEWAGE DISPOSAL: 1 secondary plant* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: California-American Water Corporation. Expansion Plans: None *Flow capacity 2.5 million gallons per day. Actual flow is 1.5 million gallons per day.	Service efficiency is inadequate.
CARMEL VALLEY 36°28'N 121°43'W Monterey County, California	CENSUS 1970: 3026 ESTIMATED 1975: 3659 PROJECTED 1980: No data Unicorporated	HOUSES: Total Number: 1501 Number of Rentals: 213 Average Monthly Rent: $290 Percent Rental Vacancies: 4% New House Starts: No data Average Number of Sales Per Year: 5 Average Sale Price: $55,000 APARTMENTS: Total Number: 68 Average Monthly Rent: $290 Average Percent Vacant: 2%	ELEMENTARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 400 1975 Enrollment: 378 1980 Projection: 350	DOCTORS: Total Number: 4 Doctor/Population Ratio: 1:915 DENTIST: Total number: 4 Dentist/Population Ratio: 1:915	ATHLETIC FIELDS: 1 located at the elementary school TENNIS COURTS: No public courts	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil. Future Plans: None SEWAGE DISPOSAL: No data HEATING FUELS: Types Available: Natural gas oil, and LPG* Expansion Plans: Gas mains will be extended as practical. WATER SUPPLY: Source: Private companies; individual wells. Expansion Plans: No connections. Banned because of inadequacy of supply. Expansion under study, but not likely in near future. *LPG – liquified propane gas	Part of Pacific Gas and Electric Co. integrated system, with main generation at Moss Landing Plant.
CUPERTINO 37°19'N 122°02'W Santa Clara County, California	CENSUS 1970: 17,895 ESTIMATED 1975: 22,023 PROJECTED 1980: No data	HOUSES: Total Number: 4925 Number of Rentals: No data Average Monthly Rent: $279 Percent Rental Vacancies: 7% New House Starts: 126 Average Number of Sales Per Year: 511 Average Sale Price: $45,000 APARTMENTS: Total Number: 3012 Average Monthly Rent: $264 Average Percent Vacant: .6%	ELEMENTARY SCHOOLS: Number of Schools: 8 Enrollment Capacity: 3420 1975 Enrollment: 2985 1980 Projection: 2804 JR. HIGH SCHOOL: Number of Schools: 2 Enrollment Capacity: 1926 1975 Enrollment: 1638 1980 Projection: 1540 SECONDARY SCHOOLS: Number of Schools: 3 Enrollment Capacity: 7650 1975 enrollment: 6903 1980 Projection: 5793 COLLEGES: Number of Schools: 1 10,871 Students; De Anza College	DOCTORS: Total Number: 32 Doctor/Population Ratio: 1:688 DENTISTS: Total Number: 40 Dentist/Population Ratio: 1:551	PARKS: 9 ATHLETIC FIELDS: 12 TENNIS COURTS: 36 GOLF COURSES: 2	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Hydroelectric power Future Plans: None SEWAGE DISPOSAL: No data HEATING FUELS: Types Available: Electricity and natural gas. Expansion Plans: More lines as needed. WATER SUPPLY: Source: Wells; Santa Clara Company District. Expansion Plans: None	Adequacy of service is very good.

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
FREEDOM 36°57'N 121°47'W Santa Cruz County, California	CENSUS 1970: 5563 ESTIMATED 1975: 5776 PROJECTED 1980: 7200 Unicorporated	HOUSES: Total Number: 1736 Number of Rentals: 463 Average Monthly Rent: $150 Percent Rental Vacancies: 4% New House Starts: 2 Average Number of Sales Per Year: 8 Average Sale Price: $35,000 APARTMENTS: Total Number: 14 Average Monthly Rent: $125 Average Percent Vacant: None	ELEMENTARY SCHOOLS: Number of Schools: 4 Enrollment Capacity: 1914 1975 Enrollment: 2060 1980 Projection: 2235 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 608 1975 Enrollment: 606 1980 Projection: 624	DOCTORS: Total Number: 12 Doctor/Population Ratio: 1:1481	PARKS: 3 ATHLETIC FIELDS: 5 GOLF COURTS: 2 Athletic Fields located only at the school.	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil Future Plans: Depends on population, increase-uncertain so far. SEWAGE DISPOSAL: Primary, uses facility in Watsonville.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: City of Watsonville; wells. Expansion Plans: Expands as new wells are added near Watsonville. *1.3 million gallons per day flow capacity is allotted to Freedom from Watsonville. Actual flow is 800,000 gallons per day.	Part of Pacific Gas and Electric's integrated system, with main plant at Moss Landing Adequacy of service is very good.
GILROY 37°20'N 121°34'W Santa Clara County, California	CENSUS 1970: 12,665 ESTIMATED 1975: 17,500 PROJECTED 1980: 23,000	HOUSES: Total Number: 4016 Number of Rentals: No data Average Monthly Rent: $375 Percent Rental Vacancies: None New House Starts: 300 Average Number of Sales Per Year: 300 Average Sale Price: $50,000 APARTMENTS: Total Number: 1559 Average Monthly Rent: $190 Average Percent Vacant: None	ELEMENTARY SCHOOLS: Number of Schools: 6 Enrollment Capacity: 2912 1975 Enrollment: 3251 1980 Projection: 4332 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 956 1975 Enrollment: 1048 1980 Projection: No data SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 1244 1975 Enrollment: 1467 1980 Projection: 1687 COLLEGES: Number of Schools: 1 1643 Students; Gavilan College	DOCTORS: Total Number: 22 Doctor/Population Ratio: 1:795 DENTISTS: Total Number: 16 Dentist/Population Ratio: 1:1094 HOSPITALS: Total Number: 1 Total Beds: 46 Intensive Care Units: 1 Total Beds: 3 Coronary Care Units: 1 Total Beds: 3 Planned Expansion: No data	PARKS: 7 ATHLETIC FIELDS: 16 TENNIS COURTS: 20 GOLF COURSES: 1	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Fossil, geothermal, natural gas, nuclear. Future Plans: Hydroelectric plant at Diablo Canyon. SEWAGE DISPOSAL: 1 primary plant.* HEATING FUELS: Types Available: Electricity and Natural gas. Expansion Plans: None WATER SUPPLY: Source: City wells. Expansion Plans: One additional well to be constructed. *3.7 millions gallons per day. flow capacity; 2.7 millions per day actual flow.	Adequacy of service is good during normal rainfall and water table heights.
GONZALES 36°30'N 121°27'W Monterey County, California	CENSUS 1970: 2550 ESTIMATED 1975: 2619 PROJECTED 1980: 3000	HOUSES: Total Number: 390 Number of Rentals: 260 Average Monthly Rent: $225 Percent Rental Vacancies: 1% New House Starts: 4 Average Number of Sales Per Year: 4 Average Sale Price: $45,000 APARTMENTS: Total Number: 218 Average Monthly Rent: $200 Average Percent Vacant: 1%	ELEMENTARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: No data 1975 Enrollment: 300 1980 Projection: 400 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: No data 1975 Enrollment: 375 1980 Projection: 450 SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: No data 1975 Enrollment: 900 1980 Projection: 1100	DOCTORS: Total Number: 2 Doctor/Population Ratio: 1:1310 DENTISTS: Total Number: 1 Dentist/Population Ratio: 1:2619 HOSPITALS: Total Number: 1 Total Beds: No data Intensive Care Units: None Coronary Care Units: None Planned Expansion: None	PARKS: 2 ATHLETIC FIELDS: 4 TENNIS COURTS: 8	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Fossil fuel Future Plans: Depends on population expansion. SEWAGE DISPOSAL: 1 plant using percolation ponds.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Wells Expansion Plans: None *600,000 gallons per day flow capacity. Actual flow is 530,900 gallons per day.	Connected to the Pacific Gas and Electric Co. integrated system. Main generators at Moss Landing. Adequacy of service is sufficient.
GREENFIELD 36°19'N 121°15'W Monterey County, California	CENSUS 1970: 2600 ESTIMATED 1975: 3386 PROJECTED 1980: 4200	HOUSES: Total Number: 1100 Number of Rentals: 150 Average Monthly Rent: $280 Percent Rental Vacancies: 1% New House Starts: 150 Average Number of Sales Per Year: No data Average Sale Price: $35,000 APARTMENTS: Total Number: 180 Average Monthly Rent: $180 Average Percent Vacant: 1%	ELEMENTARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: 950 1975 Enrollment: 960 1980 Projection: 1050	DOCTORS: Total Number: 2 Doctor/Population Ratio: 1:1693	PARKS: 2 ATHLETIC FIELDS: 1 TENNIS COURTS: 1	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Fossil fuel Future Plans: New lines as per new population. SEWAGE DISPOSAL: 1 plant using percolation ponds.* HEATING FUELS: Type Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Wells Expansion Plans: None *Flow capacity 500,000 gallons per day. Actual flow at 250,000 gallons per day.	From Pacific Gas and Electric Co. integrated system, with most power generated at Moss Landing. Adequacy of service is good during normal rainfall and water table heights.
HOLLISTER 36°51'N 121°24'W San Benito County California	CENSUS 1970: 8050 ESTIMATED 1975: 8750 PROJECTED 1980: 9500	HOUSES: Total Number: 3224 Number of Rentals: 1526 Average Monthly Rent: $300 Percent Rental Vacancies: 3% New House Starts: 56 Average Number of Sales Per Year: 54 Average Sale Price: $50,000 APARTMENTS: Total Number: 640 Average Monthly Rent: $200 Average Percent Vacant: 5%	ELEMENTARY SCHOOLS: Number of Schools: 4 Enrollment Capacity: No data 1975 Enrollment: 1870 1980 Projection: 2200 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 650 1975 Enrollment: 525 1980 Projection: 550 SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 1600 1975 Enrollment: 1475 1980 Projection: 1800 COLLEGES: Number of Schools: No data	DOCTORS: Total Number: 12 Doctor/Population Ratio: 1:729 DENTISTS: Total Number: 3 Dentist/Population Ratio: 1:2917 HOSPITALS: Total Number: 1 Total Beds: 50 Intensive Care Units: 1 Total Beds: 2 Coronary Care Units: 1 Total Beds: 2 Planned Expansion: No data	PARKS: 3 ATHLETIC FIELDS: 2 TENNIS COURTS: 3 GOLF COURSES: 2	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Fuel oil Future Plans: None SEWAGE DISPOSAL: 1 Primary plant.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: City of Hollister and Sunnyslope Water District. Expansion Plans: Continually expanding *Flow capacity 1.2 million gallons per day. Actual flow is 1.0 million gallons per day.	Adequacy of service is excellent.
KING CITY 36°12'N 121°08'W Monterey County, California	CENSUS 1970: 3717 ESTIMATED 1975: 4690 PROJECTED 1980: 5200	HOUSES: Total Number: 1800 Number of Rentals: 725 Average Monthly Rent: $142 Percent Rental Vacancies: 11.8% New House Starts: No data Average Number of Sales Per Year: No data Average Sale Price: $55,000 APARTMENTS: Total Number: No data Average Monthly Rent: No data Average Percent Vacant: No data	ELEMENTARY SCHOOLS: Number of Schools: 3 Enrollment Capacity: 1300 1975 Enrollment: 1212 1980 Projection: 1500 SECONDARY SCHOOL: Number of Schools: 1 Enrollment Capacity: 900 1975 Enrollment: 900 1980 Projection: 1000	DOCTORS: Total Number: 6 Doctor/Population Ratio: 1:782 DENTISTS: Total Number: 5 Dentist/Population Ratio: 1:938 HOSPITALS: Total Number: 1 Total Beds: 42 Intensive Care Units: 1 Total Beds: 4 Coronary Care Units: 1 Total Beds: 4 Planned Expansion: No data	PARKS: 1 ATHLETIC FIELDS: 3 TENNIS COURTS: 5 GOLF COURSES: 1 nine hole golf course.	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil Future Plans: None SEWAGE DISPOSAL: 2 oxidation ponds.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Wells Expansion Plans: None *Flow capacity 2 million gallons per day. Actual flow is 500,000 gallons per day.	Part of Pacific Gas and Electric's integrated system with most output from large Moss Landing plant.

B. URBAN AREAS (Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
LOS GATOS 37°14'N 121°57'W Santa Clara County, California	CENSUS 1970: 22,613 ESTIMATED 1975: 23,882 PROJECTED 1980: No data	HOUSES: Total Number: 8851 Number of Rentals: 2925 Average Monthly Rent: No data Percent Rental Vacancies: 4.3% New House Starts: No data Average Number of Sales Per Year: No data Average Sale Price: No data APARTMENTS: Total Number: 3383 Average Monthly Rent: No data Average Percent Vacant: No data	ELEMENTARY SCHOOLS: Number of Schools: 7 Enrollment Capacity: 2800 1975 Enrollment: 2406 1980 Projection: 2043 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 1000 1975 Enrollment: 918 1980 Projection: 700 SECONDARY SCHOOLS: Number of Schools: 3 Enrollment Capacity: 4500 1975 Enrollment: 4410 1980 Projection: 4063 COLLEGES: Number of Schools: No data	DOCTORS: Total Number: 112 Doctor/Population Ratio: 1:213 DENTISTS: Total Number: 43 Dentist/Population Ratio: 1:555 HOSPITALS: Total Number: 2 Total Beds: 290 Intensive Care Units: 2 Total Beds: 10 Coronary Care Units: 2 Total Beds: 11 Planned Expansion: No data	PARKS: 9 ATHLETIC FIELDS: 2 TENNIS COURTS: 8	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil. Future Plans: None SEWAGE DISPOSAL: No data HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: San Jose Water Works Expansion Plans: None	Part of Pacific Gas and Electric's integrated system with main power generation at Moss Landing plant.
MARINA 36°42'N 121°47'W Monterey County, California	CENSUS 1970: 9770 ESTIMATED 1975: 12,100 PROJECTED 1980: 16,000 Unincorporated	HOUSES: Total Number: 2925 Number of Rentals: 785 Average Monthly Rent: $150 Percent Rental Vacancies: 3.2% New House Starts: 33 Average Number of Sales Per Year: 33 Average Sale Price: $35,000 APARTMENTS: Total Number: 1126 Average Monthly Rent: No data Average Percent Vacant: 16.4%	ELEMENTARY SCHOOLS: Number of Schools: 4 Enrollment Capacity: 1755 1975 Enrollment: 1715 1980 Projection: 1575 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 525 1975 Enrollment: 512 1980 Enrollment: 368	DENTISTS: Total Number: 3 Dentist/Population Ratio: 1:4033	TENNIS COURTS: 4	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Hydroelectric, nuclear, and thermal. Future Plans: None SEWAGE DISPOSAL: 1 secondary plant using activated sludge method.* HEATING FUELS: Types Available: Natural gas Expansion Plans: Alcan pipeline (Western leg) for California. WATER SUPPLY: Source: Marina Water District and wells. Expansion Plans: Yes, additional source needed because of salt-water intrusion. *Flow capacity is 2 million gallons per day. Actual flow is 900,000 gallons per day.	Adequacy of service is excellent.
MONTEREY 35°35'N 121°55'W Monterey County, California	CENSUS 1970: 26,302 ESTIMATED 1975: 27,401 PROJECTED 1980: 28,371	HOUSES: Total Number: 5591 Number of Rentals: No data Average Monthly Rent: No data Percent Rental Vacancies: 3.6% New House Starts: 34 Average Number of Sales Per Year: 282 Average Sale Price: $63,700 APARTMENTS: Total Number: 5743 Average Monthly Rent: $233 Average Percent Vacant: 4.2%	ELEMENTARY SCHOOLS: Number of Schools: 20 Enrollment Capacity: 9930 1975 Enrollment: 9189 1980 Projection: 8361 JR. HIGH SCHOOL: Number of Schools: 5 Enrollment Capacity: 3836 1975 Enrollment: 3639 1980 Projection: 2783 SECONDARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: 3150 1975 Enrollment: 3073 1980 Projection: 2737 COLLEGES: Number of Schools: 8 Total Enrollment: 13,871 Antioch College Gavilian College Chapman College Golden Gate College Lincoln University Monterey Institute of Foreign Studies Monterey Peninsula College Naval Postgraduate School	DOCTORS: Total Number: 180 Doctor/Population Ratio: 1:152 DENTISTS: Total Number: 75 Dentist/Population Ratio: 1:365 HOSPITALS: Total Number: 2 Total Beds: 208 Intensive Care Units: 2 Total Beds: 14 *Coronary Care Units: 2 Total Beds: 14 Planned Expansion: No data *CCU is comibined with ICU in same unit.	PARKS: 12 ATHLETIC FIELDS: 4 TENNIS COURTS: 6 GOLF COURSES: 5	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Hydroelectric, geothermnal, and nuclear. Future Plans: None SEWAGE DISPOSAL: 1 Secondary plant.* HEATING FUELS: Types Available: Natural gas Expansion Plans: Alaska Pipeline; liquified natural gas from Indonesia and Alaska. WATER SUPPLY: Source: Surface water and wells. Expansion Plans: Additional storage capabilities or new water sources must be developed. *Flow capacity is 4.6 million gallons per day. Actual flow is 2 million gallons per day.	Adequacy of service is good, but rationing imposed in 1977.
MORGAN HILL 37°09'N 121°39'W Santa Clara County, California	CENSUS 1970: 5579 ESTIMATED 1975: 10,050 PROJECTED 1980: 19,000	HOUSES: Total Number: 1713 Number of Rentals: No data Average Monthly Rent: No data Percent Rental Vacancies: No data New House Starts: 412 Average Number of Sales Per Year: No data Average Sale Price: $37,000 APARTMENTS: Total Number: 553 Average Monthly Rent: No data Average Percent Vacant: No data	ELEMENTARY SCHOOLS: Number of Schools: 7 Enrollment Capacity: 3834 1975 Enrollment: 3285 1980 Projection: 6516 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 810 1975 Enrollemnt: 997 1980 Projection: 3135 SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 1800 1975 Enrollment: 1730 1980 Projection: 2782 COLLEGES: Number of Schools: No data		PARKS: 3 ATHLETIC FIELDS: 12 TENNIS COURTS: 14 GOLF COURSES: 3	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil. Future Plans: None SEWAGE DISPOSAL: 1 secondary plant.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Water table well. Expansion Plans: No data *Flow capacity is 3.7 million gallons per day. Actual flow is 2.7 million gallons per day.	Part of Pacific Gas and Electric Co. integrated system with most power coming from plant at Moss Landing.
PACIFIC GROVE 36°36'N 121°56'W Monterey County, California	CENSUS 1970: 13,505 ESTIMATED 1975: 16,200 PROJECTED 1980: No data	HOUSES: Total Number: 7525 Number of Rentals: 2868 Average Monthly Rent: $350 Percent Rental Vacancies: 1% New House Starts: 5 Average Number of Sales Per Year: 200 Average Sale Price: $40,000 APARTMENTS: Total Number: 1640 Average Monthly Rent: $240 Average Percent Vacant: 5%	ELEMENTARY SCHOOLS: Number of Schools: 4 Enrollment Capacity: 1610 1975 Enrollment: 1513 1980 Projection: 1402 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 541 1975 Enrollment: 505 1980 Projection: 413 SECONDARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: 1126 1975 Enrollment: 1121 1980 Projection: 1106 COLLEGES: Number of Schools: 1 Hopkins Marine Station	DOCTORS: Total Number: 10 Doctor/Population Ratio: 1:1650	PARKS: 13 ATHLETIC FIELDS: 7 TENNIS COURTS: 13 GOLF COURSES: 1	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil. Future Plans: None SEWAGE DISPOSAL: No data HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Wells Expansion Plans: Already have excess capacity for the present population.	Part of Pacific Gas and Electric Co. integrated system, with most power generated at Moss Landing. Adequacy of service is very good.
SALINAS 36°40'N 121°38'W Monterey County, California	CENSUS 1970: 58,896 ESTIMATED 1975: 68,600 PROJECTED 1980: 79,890	HOUSES: Total Number: 24,717 Number of Rentals: 8205 Average Monthly Rent: $375 Percent Rental Vacancies: 0.4% New House Starts: 450 Average Number of Sales Per Year: No data Average Sale Price: $63,500 APARTMENTS: Total Number: 7017 Average Monthly Rent: $184 Average Percent Vacant: No data	ELEMENTARY SCHOOLS: Number of Schools: 19 Enrollment Capacity: No data 1975 Enrollment: 8139 1980 Projection: No data JR. HIGH SCHOOL: Number of Schools: 2 Enrollment Capacity: No data 1975 Enrollment: 2667 1980 Projection: No data SECONDARY SCHOOLS: Number of Schools: 3 Enrollment Capacity: No data 1975 Enrollment: 6731 1980 Projection: No data COLLEGES: Number of Schools: 1 4074 Students, Hartness College	DOCTORS: Total Number: 110 Doctor/Population Ratio: 1:624 DENTISTS: Total Number: 55 Dentist/Population Ratio: 1:1248 HOSPITALS: Total Number: 3 Total Beds: 441 Intensive Care Units: 3 Total Beds: 54 *Coronary Care Units: 3 Total Beds: 54 Planned Expansion: No data *I.C.U. combined with C.C.U. facility.	PARKS: 21 ATHLETIC FIELDS: 8 GOLF COURSES: 5	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil. Future Plans: None SEWAGE DISPOSAL: 2 secondary plant.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: No data Expansion Plans: No data *Flow capacity is 9.0 million gallons per day. Actual flow is 7 million gallons per day.	Part of Pacific Gas and Electric Co. integrated system, with most power generated at Moss landing.

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
SAN JOSE 37°19'N 121°52'W Santa Clara County, California	CENSUS 1970: 459,913 ESTIMATED 1975: 551,224 PROJECTED 1980: 625,000	HOUSES: Total Number: 31,717 Number of Rentals: 24,000 Average Monthly Rent: $200 Percent Rental Vacancies: 2.5% New House Starts: 3,600 Average Number of Sales Per Year: 13,000 Average Sale Price: $46,000 APARTMENTS: Total Number: 52,934 Average Monthly Rent: $150 Average Percent Vacant: 4.3%	ELEMENTARY SCHOOLS: Number of Schools: 237 Enrollment Capacity: No data 1975 Enrollment: 114,949 1980 Projection: 115,000 JR. HIGH SCHOOL: All are combined junior/senior high schools. SECONDARY SCHOOLS: Number of Schools: 31 Enrollment Capacity: No data 1975 Enrollment: 56,418 1980 Projection: 65,000 COLLEGES: Number of Schools: 3 Total Enrollment: 19,167 San Jose State University San Jose Bible College San Jose City College	DOCTORS: Total Number: 667 Doctor/Population Ratio: 1:826 DENTISTS: Total Number: 311 Dentist/Population Ratio: 1:1772 HOSPITALS: Total Number: 7 Total Beds: 2471 Intensive Care Units: 7 Total Beds: 91 Coronary Care Units: 7 Total Beds: 62 Planned Expansion: No data	PARKS: 2300 acres of park ATHLETIC FIELDS: 27 TENNIS COURTS: 270 GOLF COURSES: 11	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Fossil fuel Future Plans: None SEWAGE DISPOSAL: 1 secondary plant.* HEATING FUELS: Types Available: Gas and electric Expansion Plans: None WATER SUPPLY: Source: San Jose Water Works Great Oaks Water Co. San Jose Municipal Water Co. Expansion Plans: San Felipe Project *Flow capacity is 160 million gallons per day. Actual flow is 90 million gallons per day.	Service is adequate.
SANTA CLARA 37°21'N 121°59'W Santa Clara County, California	CENSUS 1970: 87,717 ESTIMATED 1975: 82,978 PROJECTED 1980: 81,500	HOUSES: Total Number: 15,963 Number of Rentals: 14,081 Average Monthly Rent: $350 Percent Rental Vacancies: 2.5% New House Starts: 95 Average Number of Sales Per Year: 720 Average Sale Price: $55,000 APARTMENTS: Total Number: 10,756 Average Monthly Rent: $230 Average Percent Vacant: 2.5%	ELEMENTARY SCHOOLS: Number of Schools: 25 Enrollment Capacity: 13,451 1975 Enrollment: 14,251 1980 Projection: 9650 JR. HIGH SCHOOL: All schools are combined junior/senior high schools. SECONDARY SCHOOLS: Number of Schools: 5 Enrollment Capacity: 6280 1975 Enrollment: 7000 1980 Projection: 5285 COLLEGES: Number of Schools: 1 3339 Students; University of California at Santa Clara	DOCTORS: Total Number: 64 Doctor/Population Ratio: 1:1297 DENTISTS: Total Number: 33 Dentist/Population Ratio: 1:2415 HOSPITALS: Total Number: 1 Total Beds: 322 Intensive Care Units: 1 Total Beds: 11 Coronary Care Units: 1 Total Beds: 10 Planned Expansion: No data	PARKS: 25 ATHLETIC FIELDS: 5 TENNIS COURTS: 46 GOLF COURSES: 2	ELECTRIC POWER: Source: Wholesale supplier plus United states Bureau of Reclamation Type: Fossils and hydroelectric Future Plans: None SEWAGE DISPOSAL: 1 advanced secondary plan.** HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Wells Expansion Plans: Additional storage plus extension of transmission and distribution network. **Flow capacity is 160 million gallons per day. Actual flow is 100 million gallons per day.	Adequacy of service is excellent.
SANTA CRUZ 36°58'N 122°01'W Santa Cruz County, California	CENSUS 1970: 32,076 ESTIMATED 1975: 37,000 PROJECTED 1980: 40,000	HOUSES: Total Number: 10,122 Number of Rentals: 3000 Average Monthly Rent: No data Percent Rental Vacancies: 1.8% New House Starts: 264 Average Number of Sales Per Year: No data Average Sale Price: No data APARTMENTS: Total Number: 5318 Average Monthly Rent: $150 Average Percent Vacant: 1.8%	ELEMENTARY SCHOOLS: Number of Schools: 6 Enrollment Capacity: 3275 1975 Enrollment: 2968 1980 Projection: No data JR. HIGH SCHOOL: Number of Schools: 2 Enrollment Capacity: 1332 1975 Enrollment: 1228 1980 Projection: No data SECONDARY SCHOOLS: Number of Schools: 3 Enrollment Capacity: 4425 1975 Enrollment: 3835 1980 Projection: No data COLLEGES: Number of Schools: 2 Total Enrollment: 5109 Bethany Bible College University of Calif. at Santa Cruz	DOCTORS: Total Number: 189 Doctor/Population Ratio: 1:195 DENTISTS: Total Number: 93 Dentist/Population Ratio: 1:398 HOSPITALS: Total Number: 3 Total Beds: 352 Intensive Care Units: 2 Total Beds: 15 Coronary Care Units: 1 Total Beds: 4 Planned Expansion: No data	PARKS: 20 ATHLETIC FIELDS: 8 TENNIS COURTS: 5 GOLF COURSES: 1	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Gas and Petroleum Future Plans: None SEWAGE DISPOSAL: 1 primary plant.* HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: Streams and river. Expansion Plans: None *Flow capacity is 21 million gallons per day. Actual flow is 8.0 million gallons per day.	Service is adequate for additional population of 7000.
SARATOGA 37°16'N 122°02'W Santa Clara County, California	CENSUS 1970: 27,110 ESTIMATED 1975: 29,150 PROJECTED 1980: 31,000	HOUSES: Total Number: 8528 Number of Rentals: 611 Average Monthly Rent: $350 Percent Rental Vacancies: 3% New House Starts: 106 Average Number of Sales Per Year: No data Average Sale Price: $113,000 APARTMENTS: Total Number: 75 Average Monthly Rent: $350 Average Percent Vacant: 1%	ELEMENTARY SCHOOLS: Number of Schools: 10 Enrollment Capacity: 5200 1975 Enrollment: 4828 1980 Projection: 4800 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 1800 1975 Enrollment: 1026 1980 Projection: 1200 SECONDARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: 4000 1975 Enrollment: 3450 1980 Projection: 3500 COLLEGES: Number of Schools: No data	DOCTORS: Total Number: No data DENTISTS: Total Number: No data HOSPITALS: Total Number: 2 convalescent hospitals. Total Beds: 185 Intensive Care Units: None Coronary Care units: None	PARKS: 5 ATHLETIC FIELDS: 4 TENNIS COURTS: 100 GOLF COURSES: 1	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Fossil fuel substation Future Plans: None SEWAGE DISPOSAL: No data HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: San Jose Water Works Expansion Plans: The expansion of service in the Hillside area.	Service is adequate.
SEASIDE 36°36'N 121°51'W Monterey County, California	CENSUS 1970: 20,165 ESTIMATED 1975: 20,391 PROJECTED 1980: No data	HOUSES: Total Number: 6162 Number of Rentals: No data Average Monthly Rent: No data Percent Rental Vacancies: No data New House Starts: 55 Average Number of Sales Per Year: No data Average Sale Price: No data APARTMENTS: Total Number: 1203 Average Monthly Rent: No data Average Percent Vacant: No data	ELEMENTARY SCHOOLS: Number of Schools: 6 Enrollment Capacity: No data 1975 Enrollment: 2403 1980 Projection: No data JR. HIGH SCHOOL: Number of Schools: 2 Enrollment Capacity: No data 1975 Enrollment: 1379 1980 Projection: No data COLLEGES: Number of Schools: No data	DOCTORS: Total Number: 5 Doctor/Population Ratio: 1:4078 DENTISTS: Total Number: 10 Dentist/Population Ratio: 1:2039	PARKS: 15 ATHLETIC FIELDS: 1 TENNIS COURTS: 3	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Fossil/hydroelectric Future Plans: None SEWAGE DISPOSAL: 1 secondary plant. HEATING FUELS: Types Available: Natural gas Expansion Plans: None WATER SUPPLY: Source: California-American Water Co. Expansion Plans: None	Supply is adequate.
SOLEDAD 36°25'N 121°19'W Monterey County, California	CENSUS 1970: 4222 ESTIMATED 1975: 5342 PROJECTED 1980: 6088	HOUSES: Total Number: 1353 Number of Rentals: 357 Average Monthly Rent: $180 Percent Rental Vacancies: 5.3% New House Starts: 48 Average Number of Sales Per Year: No data Average Sale Price: $37,500 APARTMENTS: Total Number: 136 Average Monthly Rent: $200 Average Percent Vacant: 15.4%	ELEMENTARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: 1550 1975 Enrollment: 1473 1980 Projection: 1550 Plus JR. HIGH SCHOOL: Combination junior/senior high school. SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 800 1975 Enrollment: 830 1980 Projection: No data COLLEGES: Number of Schools: No data	DOCTORS: Total Number: 1 Doctor/Population Ratio: 1:5342 DENTISTS: Total Number: 2 Dentist/Population Ratio: 1:2671 HOSPITALS: Total Number: No data	PARKS: 2 ATHLETIC FIELDS: 4 TENNIS COURTS: 2	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam generating Future Plans: None SEWAGE DISPOSAL: 1 percolation pond.* HEATING FUELS: Types Available: Natural gas, butane Expansion Plans: Deep drilling WATER SUPPLY: Source: Wells Expansion Plans: New well being planned. *Flow capacity is 530,000 gallons per day. Actual flow is 500,000 gallons per day.	Adequacy of supply is good.

B. URBAN AREAS (Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
SOQUEL 36°59'N 121°58'W Santa Cruz County, California	CENSUS 1970: 5795 ESTIMATED 1975: 6280 PROJECTED 1980: 7100 Unincorporated	HOUSES: Total Number: 2130 Number of Rentals: 544 Average Monthly Rent: $200 Percent Rental Vacancies: 4% New House Starts: 33 Average Number of Sales Per Year: 15 Average Sale Price: $38,000 APARTMENTS: Total Number: 284 Average Monthly Rent: $155 Average Percent Vacant: 4.2%	ELEMENTARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: 450 1975 Enrollment: 510 1980 Projection: 510 JR. HIGH SCHOOL: Number of Schools: 1 Enrollment Capacity: 268 1975 Enrollment: 359 1980 Projection: 375 SECONDARY SCHOOLS: Number of Schools: 1 Enrollment Capacity: No data 1975 Enrollment: 902 1980 Projection: No data	DOCTORS: Total Number: 1 Doctor/Population Ratio: 1:6280	PARKS: 2 ATHLETIC FIELDS: 1 TENNIS COURTS: 6	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil. Future Plans: None SEWAGE DISPOSAL: No plants in Soquel, use primary plant at Santa Cruz.* HEATING FUELS: Types Available: No data Expansion Plans: No data WATER SUPPLY: Source: Wells Expansion Plans: None *3.0 million gallons per day flow capacity allotted to Soquel.	Part of the Pacific Gas and Electric Co. integrated system, with most power generation from Moss Landing. Adequacy of service is very good.
SUNNYVALE 37°22'N 122°03'W Santa Clara County, California	CENSUS 1970: 102,154 ESTIMATED 1975: 105,000 PROJECTED 1980: No data	HOUSES: Total Number: 40,344 Number of Rentals: 4000 Average Monthly Rent: $400 Percent Rental Vacancies: 3% New House Starts: 533 Average Number of Sales Per Year: No data Average Sale Price: $75,000 APARTMENTS: Total Number: 552 Average Monthly Rent: $250 Average Percent Vacant: 4%	ELEMENTARY SCHOOLS: Number of Schools: 22 Enrollment Capacity: No data 1975 Enrollment: 7225 1980 Projection: 4592 JR. HIGH SCHOOL: Number of Schools: 4 Enrollment Capacity: No data 1975 Enrollment: 1639 1980 Projection: 1373 SECONDARY SCHOOLS: Number of Schools: 3 Enrollment Capacity: 7500 1975 Enrollment: 6607 1980 Projection: 6400		PARKS: 13 ATHLETIC FIELDS: 12 TENNIS COURTS: 27 public, 29 private GOLF COURSES: 3	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric fired by oil. Future Plans: None SEWAGE DISPOSAL: 1 primary and 1 secondary plant.* HEATING FUELS: Types Available: Methane and natural gas. Expansion Plans: Upgrading the entire system WATER SUPPLY: Source: Aqueduct from Yosemite. Santa Clara Valley Water District deep wells. Expansion Plans: One additional connection for Santa Clara Valley Water District, plus new wells. *Flow capacity is 22.5 million gallons per day. Actual flow is 16.0 million gallons per day.	Part of Pacific Gas and Electric Co. integrated system, with most power generated at Moss Landing. Adequacy of service is excellent.
WATSONVILLE 36°54'N 121°46'W Santa Cruz County, California	CENSUS 1970: 14,569 ESTIMATED 1975: 18,650 PROJECTED 1980: 21,360	HOUSES: Total Number: 6938 Number of Rentals: 3269 Average Monthly Rent: No data Percent Rental Vacancies: 1% New House Starts: 347 Average Number of Sales Per Year: No data Average Sale Price: No data APARTMENTS: Total Number: 1153 Average Monthly Rent: No data Average Percent Vacant: No data	ELEMENTARY SCHOOLS: Number of Schools: 9 Enrollment Capacity: 3905 1975 Enrollment: 3844 1980 Projection: 4167 JR. HIGH SCHOOL: Number of Schools: 2 Enrollment Capacity: 1227 1975 Enrollment: 1395 1980 Projection: 1551 SECONDARY SCHOOLS: Number of Schools: 2 Enrollment Capacity: 2678 1975 Enrollment: 2632 1980 Projection: 2785 COLLEGES: Number of Schools: 1 297 students.	DOCTORS: Total Number: 44 Doctor/Population Ratio: 1:424 DENTISTS: Total Number: 23 Dentist/Population Ratio: 1:811 HOSPITALS: Total Number: 1 Total Beds: 99 Intensive Care Units: 1 Total Beds: 5 Coronary Care Units: 1 Total Beds: 5 Planned Expansion: No data	PARKS: 8 ATHLETIC FIELDS: 4 TENNIS COURTS: 10 GOLF COURSES: 2	ELECTRIC POWER: Source: Pacific Gas and Electric Co. Type: Steam electric-oil fired Future Plans: None SEWAGE DISPOSAL: 1 primary plant.* HEATING FUELS: Types Available: Natural gas, electric, oil. Expansion Plans: None WATER SUPPLY: Source: Wells 75% streams 25% Expansion Plans: New well to be dug as needed. *Flow capacity is 13.5 million gallons per day. Actual flow is 7.5 million gallons per day.	Part of Pacific Gas and Electric's transmission network system. Service is adequate.

C. PORTS

NAME AND LOCATION	TYPE AND GENERAL CONDITION 1/	FACTORS LIMITING LARGEST VESSEL	HYDROLOGIC CONDITIONS AND UNUSUAL GEOPHYSICAL CONDITIONS 2/	PIERS AND WHARVES	MECHANICAL HANDLING FACILITIES	STORAGE FACILITIES 3/	CLEARANCE FACILITIES	REMARKS
Name: Alameda Naval Air Station	Type: Artificial Condition: Unknown Cargo Handling: No data	Approaches: Main ship channel minimum depth 9 m (29 ft); minimum width 610 m (2000 ft). Anchorages: Minimum depth 14 m (45 ft). Alongside Berths: Minimum depth 8 m (28 ft); maximum length 335 m (1100 ft).	Tidal Ranges: Mean range of tide is 1.2 m (4 ft); range between MLLW and MHHW is 1.7 m (5.7 ft).	Number: 4 Uses: Provide service and material to support operations of aviation activities and units of the operating forces of the Navy. Type of Construction: No data Berths: 5, length from 152 to 335 m (500 to 1100 ft); depth from 8 to 12 m (28 to 40 ft); height of decks no data.	No data	Covered Storage: 185,819 m^2 (2,000,206 ft^2) Open Storage: 291,965 m^2 (3,142,791 ft^2) Refrigerated Storage: 896 m^2 (9647 ft^2) Petroleum Products Storage: No data	Railroads: Served by Southern Pacific Transportation Company; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via state highway 17, US highway 101, and state highway 156.	Vessels must pass under two bridges before entering Alameda Air Station: The Golden Gate Bridge, and the San Francisco-Oakland Bay Bridge. 4/ Two piers have berthing accomodations for aircraft carriers including CVA's.
Name: Port of Antioch Location: 38°01'N, 121°49'W.	Type: Improved river Condition: Unknown Cargo Handling: No data	Approaches: Controlling depths in New York Slough range from 8.9 to 9.2 m (29.2 to 30.1 ft) in the West Reach and from 8.7 to 8.8 m (28.5 to 29 ft) in the East Reach; minimum width 122 m (400 ft). Anchorages: No data Alongside Berths: Minimum depth 3 m (10 ft); maximum length 238 m (780 ft).	Tidal Ranges: Mean range of tide is 1 m (3 ft); range between MLLW and MHHW is 1.5 m (5 ft).	Number: 5 Uses: For handling of fuel oil, chemicals, bulk materials, and steel. Type of Construction: Timber piles and timber decks; concrete piles and concrete decks. Berths: 6, lengths from 30.5 to 238 m, (100 to 780 ft); depths from 3 to 11.5 m (10 to 38 ft); height of deck from 2.7 to 5 m (9 to 16 ft).	Cranes and Derricks: 1 crawler crane 18 m (60 ft) boom with capacity of 18.4 metric tons (MT) (20 short tons ST); 1 crawler crane with capacity of 10.9 MT (12 ST).	Covered Storage: No facilities available. Open Storage: No facilities available. Refrigerated Storage: No facilities available. Petroleum Products: 12 storage tanks with total capacity of 2,440,000 bbl.	Railroads: Served by three lines: Sacramento Northern Railway; the Atchison, Topeka and Santa Fe Railway; and Southern Pacific Transportation Company. Connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via state highway 4, interstate highway 680, US highway 101, and state highway 156.	Vessels must pass under four bridges before entering Port of Antioch: The Golden Gate Bridge, The Richmond-San Rafael Bridge, The Benicia Bridge, and the Southern Railroad Bridge. 4/
Name: Mare Island Naval Support Activity Location: 38°06'N, 122°15'W	Type: Improved Natural Condition: Good Cargo Handling: No data	Approaches: Main ship channel minimum depth 9 m (29 ft); minimum width 610 m (2000 ft). Anchorages: Minimum depth 14 m (45 ft). Alongside Berths: Minimum depth 6 m (20 ft); maximum length 640 m (2100 ft).	Tidal Ranges: Mean range of tide is 1.2 m (4 ft); range between MLLW and MHHW is 1.7 m (5.7 ft).	Number: 7 Uses: Provide supply for assigned ships and service craft; provide overhaul, repair, alteration, drydocking and outfitting of ships and craft. Type of Construction: No data Berths: 33, lengths from 61 to 640 m (200 to 2100 ft); depths from 6 to 9 m (20 to 30 ft).	No data	No data	Railroads: Served by Southern Pacific Transportation Company; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via interstate highway 80, state highway 17, US highway 101, and state highway 156.	Vessels must pass under two bridges before entering Mare Island Naval Station: The Golden Gate Bridge, and the Richmond San Rafael Bridge. 4/
Name: Naval Support Activity Treasure Island Location: 37°49'N, 122°22'W	Type: Artifical Condition: Good Cargo Handling: No data	Approaches: Main ship channel minimum depth 9 m (29 ft); minimum width 610 m (2000 ft). Anchorages: Minimum depth 14 m (45 ft). Alongside Berths: Minimum depth 7 m (22 ft); maximum length 152 m (500 ft).	Tidal Ranges: Mean range of tide is 1.2 m (4 ft); range between MLLW and MHHW is 1.7 m (5.7 ft).	Number: 9 Uses: Provide supply and support service to fleet units. Type of Construction: No data Berths: 8, lengths from 137 to 152 m (450 to 500 ft); depths from 7 to 9 m (22 to 30 ft).	No data	No data	Railroads: No facilities available. Roads: Fort Ord connections via Interstate highway 80, US highway 101, and state highway 156.	Vessels must pass under one bridge before entering Naval Support Activity: The Golden Gate Bridge. 4/ Two piers are adequate for ships of the DE class. One pier is adequate for ships of the C-2 type hulls.

NAME AND LOCATION	TYPE AND GENERAL CONDITION[1]	FACTORS LIMITING LARGEST VESSEL	HYDROLOGIC CONDITIONS AND UNUSUAL GEOPHYSICAL CONDITIONS [2]	PIERS AND WHARVES	MECHANICAL HANDLING FACILITIES	STORAGE FACILITIES [3]	CLEARANCE FACILITIES	REMARKS
Name: Oakland Naval Supply Center Location: 37°48'N, 122°19'W	Type: Artifical Condition: Good Cargo Handling: No data	Approaches: Main ship channel minimum depth 9 m (29 ft); minimum width 610 m (2000 ft). Anchorages: Minimum depth 14 m (45 ft). Alongside Berths: Minimum depth 8.5 m (28 ft).	Tidal Ranges: Mean range of tide is 1.2 m (4 ft); range between MLLW and MHHW is 1.7 m (5.7 ft).	Number: 4 Uses: Provide supply and support service to fleet units and shore activities. Type of Construction: No data Berths: 14, depths from 8.5 to 10 m (28 to 32 ft).	No data	No data	Railroads: Served by Southern Pacific Transportation Company; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via state highway 17, US highway 101, and state highway 156.	Vessels must pass under two bridges before entering Naval Supply Center; The Golden Bridge, and the San Francisco-Oakland Bay Bridge.[4]
Name: Ports of Oakland and Alameda Location: 37°48'N, 122°18'W	Type: Improved Natural Condition: Excellent Cargo Handling: 6,179,637 MT (6,811,770 ST) handled in 1973.	Approaches: Channel to outer harbor, 10.7 m (35 ft) deep and 243.8 (800 ft) to 182.9 m (600 ft) wide. Channel to middle harbor, extends from southerly side of the Seventh Street marine terminal on the west, to 1.7 miles on an easterly direction up the inner harbor. Channel to inner harbor 7 miles long. 9.1 m (30 ft) deep. The minimum depth 9 m (30 ft); minimum width 183 m (600 ft). Anchorages: Minimum depth 7.6 m (25 ft). Alongside Berth: Minimum depth 2.1 m (7 ft) maximum length is 684.3 m (2245 ft).	Tidal Ranges: The mean diurnal range of the tide is 1.8 m (6 ft) in the outer harbor and 1.9 m (6.8 ft) at the Park Street bridge in the inner harbor.	Number: 60 Uses: For handling of petroleum products, general cargo, lumber, steel and steel products. Types of Construction: Concrete piles with asphalted concrete decks; timber piles with timber decks. Berths: 83, lengths, from 5 to 684.3 m (16 to 2245 ft); depths from 2.1 to 15 m (7 to 49 ft); height of decks from 1.8 to 6.1 m (6 to 20 ft).	Cranes and Derricks: 8 mast-and-boom derricks; 2 stiff leg derricks, 1 is .7 MT (.75 ST) and 1 is 1.8 MT (2 ST); 7 mobile cranes 1 is 9.1 MT (10 ST) 2 are 11.3 MT (12.5 ST), 1 is 20.4 MT (22.5 ST), 1 is 27.2 MT (30 ST), 1 is 45.4 MT (50 ST) and 1 is 72.6 MT (80 ST); 6 full portal traveling gantry cranes, 1 is 13.6 MT (15 ST), 5 are 31.8 MT (35 ST); 11 traveling, revolving full portal gantry cranes - 1 is 20 MT (22 ST), 1 is 36.3 MT (40 ST), 8 are 40.8 MT (45 ST), and 1 is 45.4 MT (50 ST); 2 are 54.4 MT (60 ST) traveling, revolving full portal gantry cranes, jib extensions; 4 are traveling container handling cranes; 1 is 24.9 MT (27.5 ST), 2 are 27.2 MT (30 ST), 1 is 30 MT (33 ST); 1 is 2.7 MT (3 ST) fixed revolving, hammerhead crane; 2 are 36.3 MT (40 ST) revolving, overhead gantry cranes, 2 are .4 MT (.5 ST) fixed derricks. Other Equipment: 2 are 9.1 MT (10 ST) wagon crane, jib extensions; 5 are 4.5 MT (5 ST) hydraulic mobile hoists, 2 unloading towers - 1 fixed and 1 traveling, maximum rate 16.3 MT (180 ST per hour); 5 are 27.2 MT (30 ST) straddle carriers; 30 straddle-type container transportation, 20 are 20.4 MT (22.5 ST), 10 are 31.8 MT (35 ST).	Covered Storage: 149,021.8 m² (1,604,110 ft²) Open Storage: 269,934.9 m² (2,904,489 ft²) Refrigerated Storage: 13,313 m³ (470,100 ft³) cooler space; and (1,729,700 ft³) of freezer space. Petroleum Products Storage: 17 tanks with a total capacity of 57,450 bbl.	Railroads: The port is served by three transcontinental railroads: The Atchison, Topeka and Santa Fe Railway, Southern Pacific Transportation Company (Southern Pacific Company), The Western Pacific Railroad and two switching carriers: The Alameda Belt Line and the Oakland Terminal Railroad. Northwestern Pacific Railroad also serves the San Francisco Bay area by interchanging with the Southern Pacific Transportation Company of Schellville, California; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via state highway 17, US highway 101, and state highway 156.	Three floating drydocks and seven marine railways are located at six of the waterfront marine repair plants. Lifting capacities of the floating drydocks range from 2540 MT to 36,288 MT (2800 ST to 40,000 ST). The haulout capacities of the marine railways range from 22.7 MT to 907.2 MT (25 ST to 100 ST). Nine marine repair plants service the Ports of Oakland and Alameda. Seven of these marine repair plants have waterfront facilities for the construction, repair, and conversion of oceangoing vessels, tugs, and towboats, dredges, barges and other types of small vessels. Three floating drydocks and seven marine railways are located at six of the waterfront marine repair plants. Vessels must pass under five bridges before entering Ports of Oakland and Alameda: The Golden Gate Bridge, The San Franciso-Oakland Bay Bridge, the Richmond-San Rafael Bridge, the San Mateo-Hayward Bridge and the Oakland and Alameda connected by four bridges.[4]
Name: Port of Pittsburg Location: 38°02'N, 121°53'W	Type: Improved river Condition: Unknown Cargo Handling: No data	Approaches: Controlling depths in New York Slough ranged from 8.9 to 9.2 m (29.2 to 30.1 ft) in the West Reach, and from 8.7 to 8.8 m (28.5 to 29 ft) in the East Reach; minimum width 122 m (400 ft). Anchorages: No data Alongside Berths: Minimum depth 4.3 m (14 ft); maximum length 326 m (1070 ft).	Tidal Ranges: Mean range of tide is 1 m (3 ft); range between MLLW and MHHW is 1.5 m (5 ft).	Number: 6 Uses: For handling of fuel oil, chemicals, bulk material and steel. Type of Condition: Timber piles and timber decks, concrete piles and concrete decks. Berths: 7, lengths from 47 to 326 m (154 to 1070 ft); depth from 4.3 m to 12 m (14 to 40 ft); height of deck from 3.6 to 6 m (12 to 20 ft).	Cranes and Derricks: 2 traveling full portal gantry cranes, 1 is 22.7 MT (25 ST) and 1 is 15.4 MT (17 ST) capacity. Other Equipment: 1 steel mast 6 m (20 ft) long boom with capacity of 2.3 MT (2.5 ST); 1 hoist on overhead timber structure with capacity of .9 MT (1 ST); and 1 fixed loading tower.	Covered Storage: No facilities available. Open Storage: No facilities available. Refrigerated Storage: No facilities available. Petroleum Products Storage: 18 storage tanks with total capacity of 5,417,450 bbl.	Railroads: Served by three lines, Sacramento Northern Railways; The Atchison, Topeka and Santa Fe Railway; and Southern Pacific Transportation Company; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via state highway 4, interstate highway 680, US highway 101, and state highway 156.	Vessels must pass under four bridges before entering Port of Pittsburg: The Golden Gate Bridge, the Richmond-San Rafael Bridge, the Benicia Bridge, and the Southern Pacific Railroad Bridge.[4]
Name: Port of Redwood City Location: 37°30'N, 122°14'W	Type: Improved natural Condition: Unknown Cargo Handling: 405,640 MT (447,135 ST) handled in 1974.	Approaches: Controlling channel 152.4 m (500 ft) wide and 9.1 m (30 ft) deep across the San Bruno channel 91.4 m (300 ft) wide and 9.1 m (30 ft) deep in the vicinity of Redwood Creek. Two turning basins, one is 670.6 m (2200 ft) long, from 121.9 m (400 ft) to 274.3 m (900 ft) wide, and 8.2 m (27 ft) deep; the other basin 518.2 m (1700 ft) long, approximately 274.3 m (900 ft) wide and 9.1 m (30 ft) deep. Anchorage: Minimum depth 15 m (49 ft). Alongside Berths: Minimum alongside at MLLW is 3.7 m (12 ft); maximum length 265.2 m (870 ft).	Tidal Ranges: The tidal range between MLLW and MHHW is 2.1 m (6.9 ft) at Point San Bruno 17.7 km (11 mi) north of Redwood City and 2.4 m (7.9 ft) at the Port of Redwood City. The extreme ranges at these locations are 8.7 m (12 ft) and 4 m (13 ft).	Number: 7 Uses: For handling of petroleum products, salt and dry bulk products. Types of Construction: Timber piles; concrete piles. Berths: 9, length from 18.3 to 265.2 m (60 to 870 ft); depths from 3.7 to 9.8 m (12 to 32 ft); height of decks from 3.8 to 4.9 m (12.5 to 16 ft).	Cranes and Derricks: 1 is stiff leg derrick; 1 is 90.7 MT (100 st) stiff leg derrick. Other Equipment: 2 steel loading towers, can load 839.2 MT (925 ST) per hour; 1 auxillary hoist on a jib boom.	Covered Storage: No facilities available. Open Storage: No facilities available. Refrigerated Storage: No facilities available. Petroleum Products Storage: 9 tanks with total capacity of 357,000 bbl.	Railroads: Rail tracks servicing the water front facilities at the port of Redwood City connect to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via US highway 101 and state highway 156.	Vessels must pass under three bridges before entering Redwood City harbor; The Golden Gate Bridge, The San Francisco-Oakland Bay Bridge, and the San Mateo-Hayward Bridge.[4] Facilities are not available for making motor repairs, drydocking or hauling-out large deep draft vessels at the port.
Name: Port of Richmond Location: 37°55'N, 122°22'W.	Type: Improved natural Condition: Excellent Cargo Handling: 13,393,739 MT (14,763,822 MT) handled in 1974.	Approaches: Inner harbor entrance channel minimum depth 10.7 m (35 ft); minimum width 182.3 m (600 ft). Anchorage: Minimum depth 10.7 m (35 ft). Alongside Berths: Minimum depth 2.4 m (8 ft); maximum length 506 m (1660 ft).	Tidal Ranges: Mean range of tide is 1.2 m (4 ft); range between MLLW and MHHW is 1.7 m (5.7 ft).	Number: 40 Uses: For handling of crude oil, petroleum products, general cargo, and dry and liquid bulk cargoes. Type of Construction: Timber piles and timber decks; concrete piles and concrete decks. Berths: 50, length from 8 to 506 m (26 to 1660 ft); depths from 2.4 to 11.6 m (8 to 38 ft); height of decks from 2.4 to 4.9 m (8 to 16 ft).	Cranes and Derricks: 12 traveling full portal gantry cranes, 8 are 40.8 MT (45 ST) and 4 are 45.4 MT (50 ST) capacities; 3 traveling bridge cranes, 36.3 MT (40 ST) capacities; 3 stiff leg derricks, 2 are 4.5 MT (5 ST) and 1 is 49.9 MT (55 ST) capacity; 6 revolving cranes, 4 are 54.4 MT (60 ST) and 2 are 40.8 MT (45 ST) capacities; 2 crawler cranes, 1 is 90.7 MT (100 ST) and 1 is 22.7 MT (25 ST) capacities; 6 mobile cranes, 3 are 11.3 MT (12.5 ST), 1 is 4.5 MT (5 ST), 1 is 18.1 MT (20 ST), and 1 is 31.8 MT (35 ST) capacity; 3 floating cranes; 45.4 MT (50 ST) capacity each mast-and-boom derrick, with capacity of .7 MT (.75 ST); one overhead bridge crane, with capacity of 4.5 MT (5 ST) and 3 fixed mast-and-boom derricks.	Covered Storage: 37,160 m² (400,000 ft²) Open Storage: 263,055 m² (2,830,472 ft²) Refrigerated Storage: 2832 m³ (100,000 ft³) of cooler space and 283.2 m³ (10,000 ft³) of freezer space. Petroleum Products Storage: 1436 tanks with total capacity of 19,094,000 bbl.	Railroads: Served by two lines, The Atchison, Topeka and Santa Fe Railroad and Southern Pacific Transportation Company; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via interstate highway 80, state highway 17, US highway 101, and state highway 156.	Vessels must pass under two bridges before entering Port of Richmond: The Golden Gate Bridge, and the Richmond-San Rafael Bridge.[4]

NAME AND LOCATION	TYPE AND GENERAL CONDITION 1/	FACTORS LIMITING LARGEST VESSEL	HYDROLOGIC CONDITIONS AND UNUSUAL GEOPHYSICAL CONDITIONS 2/	PIERS AND WHARVES	MECHANICAL HANDLING FACILITIES	STORAGE FACILITIES 3/	CLEARANCE FACILITIES	REMARKS
Name: Port of San Francisco Location: 37°48'N, 122°25'W	Type: Improved Natural Condition: Excellent Cargo Handling: 3,803,505 MT (3,913,071 ST) handled in 1974.	Approaches: Minimum controlling depth of main ship channel 16.7 m (55 ft); minimum width 609.6 m (2000 ft). Anchorages: Minimum depth 15 m (49 ft). Alongside Berths: Minimum depth 1.8 m (6 ft); maximum length 810 m (2657 ft).	Tidal Ranges: The tidal range between MLLW and MHHW is 1.6 m (5.6 ft) at Fort Point, and 2.2 m (7.2 ft) at the San Francisco Airport.	Number: 68 Uses: For handling of crude oil, petroleum products and dry and liquid bulk cargoes. Types of Construction: Concrete piles with asphalt surfaced concrete decks; timber piles with timber decks; concrete column supported concrete beams. Berths: 154, length from 6.1 to 810 m (20 to 2657 ft); depths from 1.8 to 15.2 m (6 to 50 ft); height of deck 1.8 to 4.3 m (6 to 14 ft).	Cranes and Derricks: 12 mobile cranes – 1 is 1.8 MT (2 ST), 1 is 5.4 MT (6 ST), 1 is 9.1 MT (10 ST), 2 are 18.1 MT (20 ST), 3 are 27 MT (30 ST), 1 is 36.3 MT (40 ST), 1 is 45.4 MT (50 ST), 1 is 104.3 MT (115 ST), and 1 is 226.3 MT (250 ST) capacity; 6 traveling container handling cranes with retractable – 2 are 36.3 MT (40 ST), 2 are 40.8 MT (45 ST), 2 are 46.3 MT (51 ST); 3 traveling revolving full portal gantry cranes – 1 is 6.8 MT (7.5 ST), 1 is 24.5 MT (27 ST), 1 is 36.3 MT (40 ST); 8 crawler cranes – 1 is 9.1 MT (10 ST), 1 is 13.6 MT (15 ST) 1 is 75.3 MT (83 ST), 2 are 90.7 MT (100 ST), 2 are 136.1 MT (150 ST), 1 is 181.4 MT (200 ST); 1 is .9 MT (1 ST) timber mast-and-boom derrick; 3 are .9 MT (1 ST) mast-and-boom derricks; 1 is 9.1 MT (10 ST) traveling revolving crane; 1 is 22.7 MT (25 ST) elevated, revolving crane; 7 traveling container handling cranes, hinged cantilever boom, 1 is 27.2 MT (30 ST), 4 are 29.9 MT (33 ST), 2 are 36.3 MT (40 ST); 2 are 36.3 MT (40 ST) traveling container handling cranes, rate 40 containers per hour; 5 are 2.7 MT (3 ST) overhead cranes; 2 are 45.4 MT (50 ST) bridge cranes; 1 is 1.8 MT (2 ST) mobile hoist. Other Equipment: 2 belt conveyor boom and vessel loading spout, rate 272 MT – 544 MT (300 ST – 600 ST) per hour; 136.1 MT (150 ST) marine tower equipped with hopper and vertical bucket belt elevator, 136.1 MT (150 ST) per hour; 1 loading tower conveyor boom, rate 145.2 MT (160 ST) per hour; 1 grain gallery, loading rate 24,000 bushels per hour.	Covered Storage: 90,140 m^2 (970,300 ft^2) Open Storage: 123,020 m^2 (1,324,224 ft^2) Refrigerated Storage: 18,711 m^3 (660,700 ft^3) of cooler space and 95,081.6 m^3 (3,357,400 ft^3) of freezer space. Petroleum Products Storage: 19 tanks with total capacity of 1,181,700 bbl. Large ocean going vessels are usually bunkered at berth by tank barges based at Richmond, total capacity 183,500 bbl.	Railroads: The port of San Francisco is served directly by three line haul railroads, the Southern Pacific Transportation Company is the only rail line entering the city by a land route. The Atchison, Topeka and Santa Fe has access to San Francisco by operating car ferry service across the Bay from Richmond and Oakland, California. The Northwestern Pacific Railroad serves the San Francisco Bay area by interchanging with the Southern Pacific Transportation Company at Schellville, California. The San Francisco Belt Railroad is a switching line which serves all of the piers on the city's downtown waterfront. Interchange connections are made by this line with the three line-haul railroads serving the port; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via interstate highway 80, US highway 101 and state highway 156.	Vessels must pass under three bridges before entering Port of San Francisco: The Golden Gate Bridge, the San Francisco–Oakland Bay Bridge, and the San Mateo–Hayward Bridge. 4/ The western navigation opening over the main ship channel of the Richmond–San Rafael Bridge has a width of 305 m (1000 ft) and a vertical clearance of 56 m (185 ft). One company based at Richmond, California operates eight tank barges with cargo carrying capacities ranging up 26,000 barrels making deliveries of bunker fuel to vessels at berth. Floating equipment serving the Port of San Francisco includes 24 tugs and towboats with ratings of up to 22,000 horse power. There are waterfront facilities at the port for the construction, repair and conversion of ocean going vessels, tugs and towboats, dredges, barges and other types of small vessels. Two floating drydocks and five marine railroads are located at three of the waterfront marine repair plants. Lifting capacities of the floating drydocks are 22,352 to 66,040 MT (22,000 to 65,000 large tons (LT). The haul-out capacities of the marine railways range from 45.4 to 294.8 MT (50 to 325 ST).
Name: Port of Stockton Location: 37°58'N, 121°20'W	Type: Improved river Condition: Excellent Cargo Handling: 3,392,637 MT (3,739,680 ST) handled in 1974.	Approaches: Controlling depths in the San Joaquin River – Stockton deep water channel. Minimum depth 8.5 m (28 ft), minimum width 121.9 m (400 ft). Anchorages: Minimum depth 9 m (30 ft). Alongside Berths: Minimum depth 2.4 m (8 ft); maximum length 308.2 m (1011 ft).	Tidal Ranges: The tidal range between MLLW and MHHW is 1.7 m (5.7 ft) at Fort Point with a maximum range of about 3.2 m (10.6 ft) the tidal range between MLLW and MHHW is 1.8 m (5.8 ft) at San Pablo Bay with a maximum range of about 3 m (10 ft). The tidal range between MLLW and MHHW is 1.8 m (5.8 ft) in the Suisun Bay with a maximum range of about 2.9 m (9.5 ft). The tidal range between MLLW and MHHW is 1.1 m (3.5 ft) at Stockton with a maximum range of about 1.4 m (4.5 ft).	Number: 27 Uses: For handling of petroleum products, molasses fertilizer, grain, lumber products, and general cargo. Type of Construction: Timber piles with timber decks; precast concrete with concrete decks. Berths: 28, length from 4.6 to 308.2 m (15 to 1011 ft); depths from 2.4 to 10.7 m (8 to 35 ft); dock height from 2.4 to 4.9 m (8 to 16 ft).	Cranes and Derricks: 3 traveling revolving full portal gantry cranes, 2 are 27.2 MT (30 ST), 1 is 9.1 MT (10 ST); 4 crawler cranes, 2 are 20 MT (22 ST), 1 is 59 MT (65 ST), 1 is 54.4 MT (60 ST); 2 mobile cranes, 1 is 9.1 MT (10 ST) and 1 is 5.4 MT (6 ST); 3 stiff leg derricks, 1 is 18.1 MT (20 ST), 1 is 4.5 MT (5 ST), and 1 timber 3.6 MT (4 ST). Other Equipment: 3 loading towers, belt conveyor maximum loading rate 544–726 MT (600–800 ST) per hour; 2 hinged belt conveyors, loading rate 249.4 MT (275 ST) per hour.	Covered Storage: 101,902 m^2 (1,096,900 ft^2) Open Storage: 495,723 m^2 (5,336,100 ft^2) Refrigerated Storage: 7533 m^3 (266,000 ft^3) of cooler space and 25,346 m^3 (895,000 ft^3) of freezer space. Petroleum Products Storage: 57 tanks with total capacity of 726,150 bbl.	Railroads: Served by three trunkline railroads; the Atchison, Topeka and Santa Fe Railway, the Southern Pacific Transportation Company and the Western Pacific Railroad; two short line carriers; the Central California Traction Company and the Stockton Terminal and Eastern Railroads; and one terminal switching line; The Stockton Public Belt Railroad; connections to Fort Ord via Southern Pacific TransportationCompany line. Roads: Fort Ord connections via interstate highway 5, 205, and 680; US highway 101; and state highway 156.	There are no facilities for making extensive repairs, dry docking or hauling out large deep draft vessels. Vessels must pass under six bridges before entering Port of Stockton: The Golden Gate Bridge, the Richmond' San Rafael Bridge, the Carquinez Bridge, the Bencia Bridge, the Southern Pacific Railroad Birdge, and the Antioch Bridge. 4/
Name: Ports of Vallejo and Carquinez Straits Location: 38°04'N, 122°13'W	Type: Improved natural Condition: Excellent Cargo Handling: (22,379,267 ST) handled in 1974.	Approaches: Dredge channel minimum depth 13.7 m (45 ft); minimum width 182.9 m (600 ft). Anchorages: Minimum depth 15 m (49 ft). Alongside Berths: Minimum depth 1.5 m (5 ft). maximum length 858 m (2815 ft).	Tidal Ranges: The tidal range between MLLW and MHHW is 1.8 m (5.8 ft) at the lower end of San Pablo Bay and opposite the Mare Island Navy Yards with a maximum range of approximately 3 m (10 ft). The tidal range between MLLW and MHHW is approximately .6 m (1.8 ft) the Suisum Bay channel with a maximum range of approximately 2.9 m (9.5 ft).	Number: 24 Uses: For handling of petroleum products, molasses, and general cargo. Drydock facilities for repairing and building vessels of all sizes. Type of Construction: Concrete piles with concrete decks; timber piles with timber decks; steel pipe piles; steel sheet piles. Berths: 33, length from 9.1 to 827.5 m (30 to 2715 ft) depths from 1.5 to 13.7 m (5 to 45 ft); heights from 2.4 to 5.8 m (8 to 19 ft).	Cranes: 2–1.8 MT (2 ST) mast-and-boom derricks; 1–4.5 MT (5 ST) mobile crane; 1 traveling straight line full portal gantry bulk unloader 1–10.9 MT (12 ST) traveling revolving crane; 4 traveling full portal gantry canes; 2–1.4 MT (1.5 ST) steel towers, level-luffing cranes; 5 steel towers, supporting booms; 5 swivel jointed loading arms; 1–45.4 MT (50 ST) stiff leg derrick.	Covered Storage: No facilities available. Open Storage: No facilities available. Refrigerated Storage: No facilities available. Petroleum Products Storage: 339 tanks with total capacity of 28,091,000 bbl.	Railroads: Served by two lines, the Atchison, Topeka and Santa Fe Railway and Southern Pacific Transportation Company; connections to Fort Ord via Southern Pacific Transportation Company line. Roads: Fort Ord connections via interstate highway 80, state highway 17, US highway 101, and state highway 156.	Vessels must pass under four bridges before entering Ports at Vallejo and Carquinez Straits: The Carquinez Bridge, the Bencia Bridge, the Southern Pacific Railroad Bridge, and the Vallejo Mare Island causeway and drawbridge. 4/

FOOTNOTES

1/ Abbreviations: MT – metric tons; ST – short tons.

2/ MLLW refers to Mean Lower Low Water, and MHHW refers to Mean Higher High Water. All depths refer to the plan of MLLW.

3/ Refrigated Storage is given in m^3 (ft^3), except for ports where only m^2 (ft^2) information ia available.

4/ The Golden Gate Bridge horizontal clearance between towers is 1228 m (4028 ft); the overhead vertical clearance at the center of the span is 71 m (232 ft) at MHHW, 65 m (213 ft) at the north tower and 64 m (211 ft) at the south tower.

The San Francisco–Oakland Bay Bridge the minimum clearance between piers is 327 m (1072 ft) and the minimum horizontal overhead clearance is 53 m (174 ft) at MHHW.

Richmond–San Rafael Bridge has a width of 305 m (1000 ft) and a vertical clearance of 56 m (185 ft).

Southern Pacific Railroad Bridge across the Suisum Bay has a minimum clearance above MHHW of 21.3 to 41.1 m (70 to 135 ft).

The San Mateo–Hayward Bridge has a horizontal clearance of 152 m (500 ft) over the ship channel and vertical clearance of 41 m (135 ft) at MHHW.

Oakland and Alameda are connected by four bridges, the minimum horizontal clearance 29 m (95 ft); the minimum overhead vertical clearance 4 m (13 ft).

Benicia Bridge (fixed highway bridge) has a minimum clearance above MHHW of 41.1 m (135 ft).

Antioch Bridge has a minimum horizontal clearance 81 m (265 ft) and minimum clearance 21 m (70 ft).

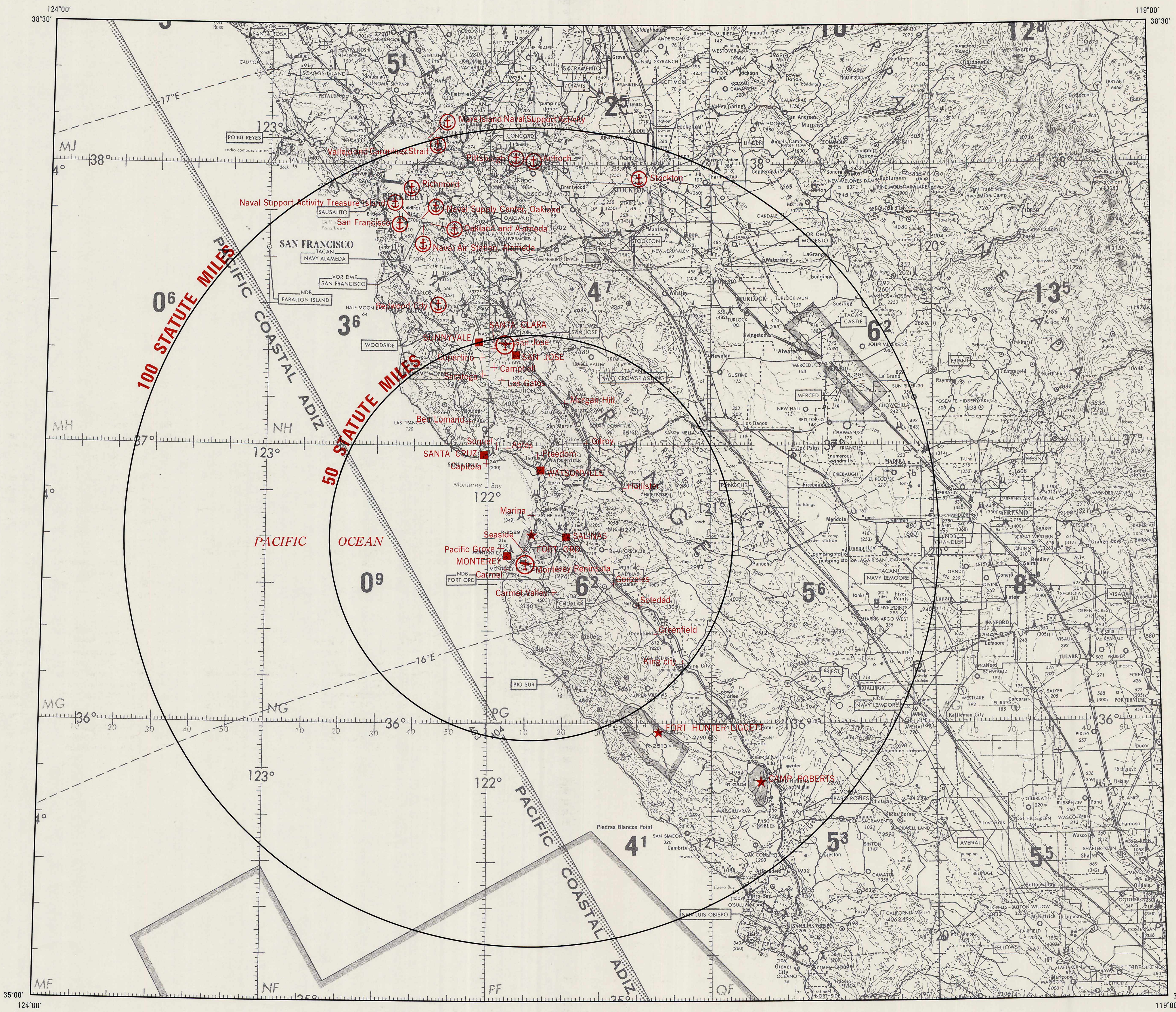
Carquinez Bridge (fixed highway bridge) has a minimum clearance above MHHW of 40.8 to 44.9 m (134 to 147 ft).

Vallejo–Mare Island Causeway and drawbridge has a minimum clearance above MHHW of 4 m (13 ft).

FORT ORD, CALIFORNIA

(INCLUDING FORT HUNTER LIGGETT, CAMP ROBERTS AND PRESIDIO OF MONTEREY)

TERRAIN ANALYSIS



SCALE 1:1,000,000

OFF-POST FEATURES

★ Cantonment Area

■ Urban Areas (Large)

+ Urban Areas (Small)

Airfield

Ports

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

FORT HUNTER LIGGETT

II. DESCRIPTION AND MILITARY ASPECTS OF TERRAIN

A. SURFACE CONFIGURATION

Fort Hunter Liggett is located in central California on the California Coast Range (mainly on the eastern side of the Santa Lucia Range) section of the Pacific Border physiographic province. Landforms consist of low, flat to gently rolling plains in the eastern part of the fort, moderately rolling to hillocky high plains in the central and southeastern areas, moderate to steep low hills scattered throughout and rounded to rugged high hills dominating most of the western and southern parts of the reservation. The low and high plains are mostly in the valleys of the Nacimiento and the San Antonio Rivers. The heavily dissected low and high hills are cut by deep canyons and steep valleys characterized by numerous rock outcrops. Streams generally trend northeast and southeast throughout the reservation.

MAP UNIT	LANDFORM	LANDFORM DESCRIPTION AND DISTRIBUTION	ELEVATIONS
1	Low Plains	Flat to gently rolling surfaces predominate in the flood plains of the lower two thirds of the San Antonio River and in the Jolon Valley along the northern border. Little or no stream dissection or rock outcrops occur. Local relief is generally less than 50 m (164 ft); slopes are largely between 0 and 3%.	Elevations are mostly between 274 and 305 m (900 and 1000 ft) above sea level. Lowest elevation, less than 244 m (800 ft), on the bank of the San Antonio Reservoir in the extreme southeast. Highest elevation, about 365 m (1200 ft), in Jolon Valley.
2	High Plains	Smooth to moderately dissected, moderately rolling surfaces predominate in the central part of the reservation in the valley of the Nacimiento River; local relief is mainly between 50 and 100 m (164 and 328 ft); slopes are commonly between 3 to 8%. Moderately dissected and hillocky surfaces cover about 70% of the areas on the eastern edge of the reservation; characterized by steep valleys and canyons; local relief is mainly between 50 and 140 m (164 and 459 ft); slopes are largely 3 to 15%, locally up to 30%. Rock outcrops occur throughout.	Elevations are largely between 354 and 427 m (1160 and 1400 ft) above sea level. Lowest elevation, less than 244 m (800 ft) on the northern bank of the San Antonio Reservoir. Highest elevation, about 488 m (1600 ft), at the foot of Bald Mountain on the southeastern side of the reservation.
3	Low Hills	Smooth to highly dissected, moderate to steep hills scattered throughout the reservation, but generally in the central and eastern half. Highly dissected, very steep ridges along the banks of the Nacimiento River trending northeastward in the central to southern parts. Local relief is mainly between 150 and 200 m (492 and 656 ft). Slopes are largely between 15 to 30%, locally 45%. Narrow valleys and canyons with local relief generally between 130 and 220 m (590 and 722 ft) appear in the northeastern and southeastern parts; slopes are mainly 30 to 45%. Rock outcrops common.	Elevations are mostly between 427 and 610 m (1400 and 2000 ft) above sea level. Lowest elevation, 256 m (840 ft), near the San Antonio Reservoir. Highest elevation, 650 m (2132 ft), on summit of Bald Mountain.
4	High Hills	Moderately rounded to rugged crests with highly dissected V-shaped valleys predominate in most of the western half of the reservation. Valleys trend mostly eastward. Rock outcrops common. Local relief is mainly between 350 and 425 m (1148 and 1394 ft); slopes are largely between 30 and 45%, locally up to 60%. Most rugged hills (Burro Mountain area) in the southern part of the unit. Local relief is mainly between 550 and 750 m (1800 and 2460 ft); slopes are largely between 45 and 60%.	Elevations are largely between 488 and 915 m (1600 and 3000 ft) above sea level. Lowest elevation, about 274 m (900 ft), on the Nacimiento River in the southern part of the unit. Aldor Peak, highest elevation, 1141 m (3744 ft), located in the southwestern part of reservation.

B. SURFACE DRAINAGE

The surface drainage of Fort Hunter Liggett consists of two river systems flowing parallel to each other in a southeasterly direction. Both river systems empty into the Salinas River approximately 24 to 32 km (15 to 20 mi) southeast of the Hunter Liggett boundary at Camp Roberts. The Nacimiento River drains the southwestern half of Hunter Liggett and the San Antonio River drains the northeastern half. Both river systems have relatively short tributaries with steep gradients and narrow valleys on their western slopes. Eastern tributaries of each river are generally longer with less gradient and wider valleys. Both river systems hug the hills to their west, which makes approaches difficult from that direction. The head waters of these major streams form in the extreme northern and western portions of the reservation, east of the Santa Lucia Mountain Range crest.

During the summer months virtually all tributaries are dry except for the flow from occassional springs. Even the two major river systems may be dry in some spots during the period July through October. Flash flooding may occur between November and April.

DRAINAGE CHARACTERISTICS

DRAINAGE CATEGORIES	GENERAL	REGIME	WIDTHS	DEPTHS	VELOCITY AND DISCHARGE	BANKS	BOTTOMS
Water Courses							
San Antonio River	Mostly perennial stream flowing through a wide, very gradually sloping flood plain, which wanders in a southeasterly direction.	High water, January through April. Low water, June through November. Flash flooding may occur November through April. Dry channels may occur July through October.	Generally from 3 m (10 ft) to 42 m (139 ft).	Mostly less than 1.0 m (3.3 ft).	Velocity generally less than 1.0 m/sec (3.3 ft/sec). Near Pleyto, discharge 5.5 m^3/sec (183 ft^3/sec) from December to April. From May to November average is about 0.2 m^3/sec (7 ft^3/sec).	Sand and some gravel. Bank heights are generally less than 1.0 m (3.3 ft).	Sand with gravel.
Nacimiento River	Mostly perennial stream flowing in a southeasterly direction. The northwestern third of the stream flows through a wide flood plain region, while the central and southeastern portions flow in a fairly narrow, often steep-sided valley.	High water, December through April. Low water, June through October. Flash flooding may occur November through April with dry channels sometimes occurring July through October.	Generally about 10 m (33 ft).	Mostly less than 1.0 m (3.3 ft)	Velocity generally less than 1.0 m/sec (3.3 ft/sec). Near Bryson discharge 10 m^3/sec (400 ft^3/sec) from December to April. From May to November average discharge generally less than 0.55 m^3/sec (19.5 ft^3/sec).	Sand and some gravel. Bank heights are generally less than 1.0 m (3.3 ft).	Sand and gravel.
Other streams	Numerous ephemeral streams feed the Nacimiento River, flowing mostly from the Santa Lucia Range to the west, while the San Antonio River is fed by ephemeral tributary streams along its entire length within the fort.	Hold water during and for several hours after heavy rains from November through April. Mostly dry from July through October.	Generally less than 1 m (3.3 ft).	No data available.	No data available.	Sand and rocky bank heights less than 0.5 m (1.7 ft).	Sand and gravel with some rock, mostly in the head waters.
Standing Bodies of Water							
Reservoirs (See tables)							

FORDS

MAP NO.	GRID COORDINATES	APPROXIMATE DEPTH m (ft)	APPROXIMATE LENGTH m (ft)	APPROXIMATE WIDTH m (ft)	BOTTOM COMPOSITION	APPROACHES COMPOSITION AND CONDITION	REMARKS
1	511929	0.3 (1)	40 (125)	8 (24)	Sand and gravel	Sand, easy	Artificial construction.
2	575864	0.3 (1)	120 (334)	8 (24)	Data not available	Sand, easy	Artificial construction.
3	578854	0.3 (1)	120 (334)	8 (24)	Data not available	Sand, easy	Artificial construction.
4	589834	0.3 (1)	80 (262)	8 (24)	Concrete	Sand, easy	Artificial construction, excellent condition for vehicles.
5	595729	0.2 (1)	99 (325)	8 (24)	Sand and gravel	Sand, easy	Artificial construction.

MEAN MONTHLY DISCHARGE
m^3/sec (ft^3/sec)

MONTH	NACIMIENTO RIVER NEAR BRYSON, CA. (Oct 1955 - Sept 1971)	NACIMIENTO RIVER AT BEL SAPAQUE, CA. NEAR BRYSON, CA. (Oct 1971 - Sept 1976)	SAN ANTONIO RIVER AT PLEYTO, CA. (Oct 1929 - Sept 1965)	SAN ANTONIO RIVER NEAR LOCKWOOD, CA. (Oct 1965 - Sept 1976)
Jan	15.12 (534)	12.43 (439)	4.50 (159)	8.78 (310)
Feb	16.45 (581)	20.87 (737)	9.29 (328)	8.24 (291)
Mar	7.90 (279)	17.08 (603)	6.15 (217)	7.67 (271)
Apr	6.71 (237)	4.28 (151)	3.82 (135)	3.29 (116)
May	1.25 (44)	0.91 (32)	0.96 (34)	1.10 (39)
Jun	0.34 (12)	0.37 (13)	0.23 (8)	1.13 (40)
July	0.06 (2)	0.06 (2)	0.03 (1)	0.06 (2)
Aug	0 (0)	0 (0)	0 (0)	0 (0)
Sept	0 (0)	0 (0)	0 (0)	0 (0)
Oct	0.11 (4)	0.03 (1)	0 (0)	0 (0)
Nov	2.12 (75)	2.86 (101)	0.17 (6)	0.42 (15)
Dec	8.38 (296)	5.21 (184)	2.80 (77)	2.80 (99)

RESERVOIRS

MAP NUMBER	NAME*	GRID COORDINATES	APPROXIMATE HECTARES (ACRES)
1	San Antonio Reservoir	765735	300 (741)**
2		709770	3.1 (8.7)
3	[Sycamore Creek Lake]	674689	1.1 (2.7)
4		669721	1.5 (3.7)
5	[El Piojo Creek Lake]	650718	2.1 (5.2)
6		628716	1.3 (3.2)
7	[Fria Creek Lake]	612732	9.0 (22.2)
8	[Los Bueyos Creek Lake #1]	574733	2.0 (4.9)
9	[Gabilan Creek Lake #1]	603744	No data available
10	[Gabilan Creek Lake #2]	593768	1.0 (2.5)
11	[Gabilan Creek Lake #3]	583784	1.7 (4.2)
12	[Gabilan Creek Lake #4]	584788	0.5 (1.2)
13	[Stony Creek Lake #1]	554805	9.5 (23.5)
14	[Stony Creek Lake #2]	516846	0.4 (1.0)
15		580828	0.4 (1.0)
16		568852	3.1 (7.7)
17		615835	1.0 (2.5)
18	[Ruby Canyon Lake]	617860	0.2 (0.5)
19		621882	1.9 (4.7)
20	[Hunter Liggett Lake #1]	589868	1.0 (2.5)
21	[Hunter Liggett Lake #2]	591876	0.14 (0.35)
22		528929	3.3 (8.2)
23	[Mission Creek Lake]	546943	5.7 (14.1)
24	[Rattle Snake Creek Lake]	445949	1.7 (4.2)
25	[Los Bueyos Creek Lake #2]	568735	0.7 (1.7)
26	[China Gulch Lake]	671762	0.9 (2.2)
27		657851	0.5 (1.2)

*Bracketed names assigned to unnamed reservoirs for clarity.
**Area measured is within reservation boundaries.

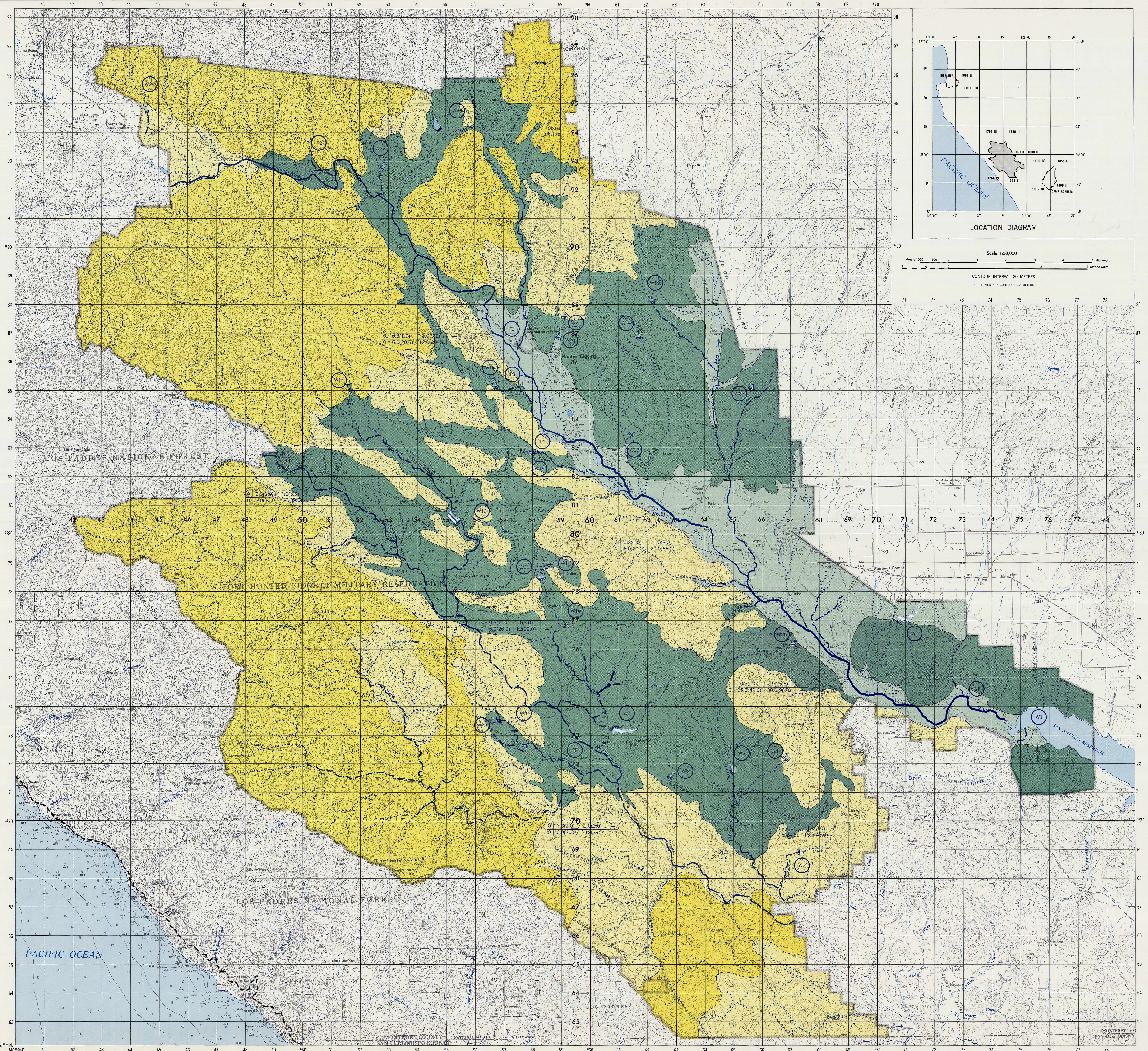
MAXIMUM STREAM DISCHARGE

GAGING STATION MAP NO.	STREAM NAME	DRAINAGE AREA ABOVE GAGE km2 (mi2)	RECORDING PERIOD	MAXIMUM MEAN MONTHLY DISCHARGE m^3/sec (ft^3/sec),	DATE
*	Nacimiento River at Bel Sapaque C. near Bryson, Ca.	156 (404.04)	Oct 1971 – Sept 1976	58.25 (2057),	Feb 1973
**	Nacimiento River near Bryson, Ca.	140 (362.6)	Oct 1955 – Sept 1971	80.94 (2858),	Jan 1969
***	San Antonio River at Pleyto, Ca.	284 (735.6)	Oct 1929 – Sept 1965	51.15 (1806),	Feb 1938
1	San Antonio River near Lockwood, Ca.	223 (577.6)	Oct 1965 – Sept 1976	42.90 (1515),	Jan 1969

*Nacimiento River gaging station is located down stream, 7 km (4.2 mi) south of Hunter Liggett boundary.

**Nacimiento River gaging station is located down stream, 5 km (3 mi) south of Hunter Liggett boundary.

***San Antonio River gaging station is located down stream, 14 km (8.4 mi) south east of Hunter Liggett boundary.



HUNTER LIGGETT, CALIFORNIA TERRAIN ANALYSIS

SURFACE CONFIGURATION

1. LOW PLAINS	Predominantly flat to gently rolling plains. Local relief mainly between 20 and 60m with slopes commonly less than 3%.
2. HIGH PLAINS	Predominantly moderately rolling to hillocky plains. Local relief between 60 and 160m with slopes generally between 0 and 15%. Slope is generally greater than 30% in the northern canyon regions.
3. LOW HILLS	Predominantly moderate to steep hills. Local relief mainly between 160 and 320m with slopes generally 30 to 45%.
4. HIGH HILLS	Predominantly steep with smooth rounded crests and V-shaped valleys. Local relief is generally between 320 and 600m with slopes generally greater than 45%.

SURFACE DRAINAGE

BANK TO BANK GAP WIDTH

- **>25m**
- **15–25m**
- **10–15m**
- **3–10m**
- **<3m**

3(9) / 35° — Bank height/slope, in m(ft)/degrees

0	0.3(1.0)	1(3.0)	—	Depth low	Normal	Bankfull	High, estimated in m(ft)
0	3.0(10.0)	12(39.0)	—	Width low	Normal	Bankfull	High

Earth dam

W1 Reservoir

G1 Gauging station

F1 Ford

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

C. WATER RESOURCES

1. SURFACE WATER

The San Antonio River and Nacimiento River provide the major portion of the surface water available for Fort Hunter Liggett. The San Antonio River, the Nacimiento River and their tributaries generally have low water most of the year with little or no water in their respective stream beds during the dry season (April to November). Because the rains are concentrated during the rest of the year (95% of the precipitation occurs from December to March), streams and rivers occasionally cause flooding during and after heavy rains, hindering transportation by foot or vehicle.

SOURCES	QUANTITY	QUALITY	ACCESS AND DEVELOPMENT
The San Antonio River flows in a northwesterly to southeasterly direction in the eastern portion of Hunter Liggett. Most populated areas within the fort are approximately 1 to 3 km (0.6 to 1.8 mi) from this river. It flows the entire length of the fort in the high to low plains regions (flood plains) and empties into a reservoir in the southeastern corner of the post.	The San Antonio River at station 1, located 5.3 km (3.3 mi) south of Lockwood, California on downstream side of bridge on Sam Jones Road, affords more than 2060 liters per minute (784,000 gpd) during the wet months, Dec to Mar. During the dry months, Apr to Nov, its discharge rate is less than 425 liters per minute (162,000 gpd).	Based on regional considerations it is likely that natural stream waters are hard, high in dissolved solids and slightly corrosive in the hills region. Sources of industrial pollution are absent. Some bacteria may collect in small ponds and suspended sediment load may be present during high water periods.	Access to the San Antonio River is excellent because of its low plains location, bank heights less than 1 m (3.3 ft), gradual slopes, and existence of several fords. This stream flows the entire length of the reservation and its depth is generally less than 0.5 m (1.7 ft).
The Nacimiento River flows in a northwesterly to southeasterly direction in the western hills of Fort Hunter Liggett. Most populated areas are greater than 10 km (6 mi) from this river. The river enters the fort in the central western high hills of Hunter Liggett on the Santa Lucia Range. It parallels the San Antonio River as it flows from the hills region to the plains region and leaves the post in its southeastern corner.	The Nacimiento River near Bryson, California, at a gaging station located 2.3 km (1.4 mi) south of Bryson on left bank of river just downstream from Sapaque Creek discharges more than 4080 liters per minute (1,550,000 gpd) during wet months, Dec to Apr. During dry months, May to Nov, it discharges less than 285 liters per minute (108,000 gpd).	Based on regional considerations it is likely that natural stream waters are hard, high in dissolved solids, and slightly corrosive in the hills region. Sources of industrial pollution are absent. Some bacteria may collect in small ponds and suspended sediment load may be present during high water periods.	Access to the northern third of the Nacimiento River is characteristically the same as the San Antonio River. This is because of its flood plain location. The central and southern reaches of the stream are located in narrow valleys with no significant flood plain. Even though the bank heights are less than 1 m (3.3 ft), access to these areas is difficult due to steep valley and ridge slopes. Most of the central and southern two-thirds of the stream is located in the low to high hills region.
Smaller streams, creeks, ponds, and earthen dams are widely distributed throughout the post. The streams and creeks generally occur in the narrow valleys in the uplands and extend into the plains of the two major rivers. The earthen dams are located in the low hills to high plains regions.	In the shallow drainage channels and gullies, waterflow occurs during and for a few hours after rains. Water may also be present in a series of ponds and earthen dams.	No data available due to intermittent nature of flow.	Access to earthen dams in the plains region is good to excellent due to the gradual slopes, roads, and trails. In the hills region, access to the streams is generally good to fair, depending on the road and trail network, and the slope.

MAJOR OFF-POST SURFACE WATER RESERVOIRS

The Nacimiento and the San Antonio Rivers drain the Fort Hunter Liggett area (Santa Lucia Range area west of the Salinas River) and empty into their respective reservoirs to the west of Camp Roberts' western boundary. The Nacimiento and the San Antonio Reservoirs parallel each other and are located less than 3 km (1.8 mi) from either Camp Roberts to the east or Hunter Liggett to the northwest.

The Nacimiento and San Antonio reservoirs each have a capacity of 350,000 acre-feet. They harness waters from the two rivers and control stream flow (rate of discharge) throughout Camp Roberts. These rivers eventually empty into the Salinas River on Camp Roberts' eastern boundary. The two reservoirs are approximately the same in terms of capacity, area, flow (discharge rate), etc., and both are used for recreation during appropriate seasons.

DAM STATISTICS

	SAN ANTONIO	NACIMIENTO
CAPACITY	43,173 hectare-m (350,000 acre-ft)	43,173 hectare-m (350,000 acre-ft)
SPILLWAY CAPACITY	34,493,760 liters per minute 9,111,858 gal/min (20,300 ft^3/sec)	110,448,000 liters per minute 29,175,900 gal/min (65,000 ft^3/sec)
RESERVOIR AREA	2315 hectares (5720 acres)	2833 hectares (7000 acres)
HEIGHT ABOVE STREAM BED	60 m (201 ft)	63 m (210 ft)
MAXIMUM DEPTH TO BEDROCK	No data available	9 m (30 ft)
LENGTH	430 m (1433 ft)	389 m (1630 ft)
WIDTH AT TOP	9 m (30 ft)	9 m (30 ft)
WIDTH AT BOTTOM	No data available	435 m (1450 ft)
YARDAGE AT DAM	118,944 m^3 (4,200,000 ft^3)	95,096 m^3 (3,357,900 ft^3)
AVERAGE ANNUAL FLOW	8203 hectare-m (66,500 acre-ft)	23,437 hectare-m (190,000 acre-ft)
MAXIMUM ANNUAL FLOW	38,239 hectare-m (310,000 acre-ft)	74,503 hectare-m (604,000 acre-ft)
LENGTH OF LAKE	26 km (16 mi)	No data available

ANALYSES OF SURFACE WATERS, FORT HUNTER LIGGETT

Map Unit	Stream Name and Date	ph (Units)	Bicarbonate HCO_3 MG/L	Hardness Ca, Mg MG/L	Non Carbonate Hardness MG/L	Dissolved Calcium (Ca) MG/L	Dissolved Magnesium (Mg) MG/L	Dissolved Sodium (Na) MG/L	Dissolved Potassium (K) MG/L	Dissolved Chloride (Cl) MG/L	Dissolved Sulfate (SO_4) MG/L	Dissolved Silica (SiO_2) MG/L	Dissolved Nitrate (NO_3) MG/L	Dissolved Fluoride (F) MG/L	Carbonate CO_3 MG/L	Dissolved Solids Tons/AC-FT
G-3	*San Antonio River	Avg 8.3	167.6	183.2	38.2	52	16	17.6	1.5	11.1	65	27	.21	--	4.4	.39
	Water Year Range Oct 1965 to Sep 1966	8.2 - 8.4	136 - 187	169 - 194	29 - 45	52	16	12 - 22	1.5	7 - 13	65	27	.21	--	0 - 8	.39
G 2	**Nacimiento River	Avg 8.3	141.7	142	23	28.5	14.5	9.7	1.2	6.2	33	11	.7	--	1.7	172.5
	Water Year Range Oct 1965 to Sep 1966	8.0 - 8.4	125 - 168	125 - 162	21 - 24	27 - 30	14 - 15	9.4 - 10	1.1 - 1.3	5.3 - 7.0	33	10 - 12	.5 - .9	--	0 - 4	172 - 173

Map Unit	Stream Name and Date	Specific Conductance (Micro-Mhos)	Total Phosphorus (P) MG/L	Total Arsenic (As) UG/L	Total Cadmium (Cd) UG/L	Total Chromium (Cr) UG/L	Total Cobalt (Co) UG/L	Total Copper (Cu) UG/L	Total Lead (Pb) UG/L	Total Mercury (Hg) UG/L	Total Zinc (Zn) UG/L	Pesticides UG/L	Dissolved Boron (B) UG/L	Fecal Coliform Col/100ML	Fecal Streptococci Col/100ML	Temperature C°
G-3	San Antonio River	418.8	--	--	--	--	--	--	--	--	--	--	0	--	--	--
	Water Year Oct 1965 to Sep 1966	371 - 440	--	--	--	--	--	--	--	--	--	--	0	--	--	--
G 2	Nacimiento River	311.8	--	--	--	--	--	--	--	--	--	--	33	--	--	--
	Water Year Oct 1965 to Sep 1966	281 - 353	--	--	--	--	--	--	--	--	--	--	0 - 100	--	--	--

* Located at Pleyto, California, now inundated by San Antonio Reservoir.

** Below Nacimiento Dam, 3.5 km (2.2 mi) downstream from the dam, immediately inside the west boundary of Camp Roberts.

2. GROUND WATER

Ground water is the sole source of water at Fort Hunter Liggett.

Fort Hunter Liggett is in the southern Coast Range Mountains and in the Salinas River Basin. The eastern boundary parallels the San Antonio River. The area occupied by Fort Hunter Liggett is still being faulted and differentially uplifted. The valley of the San Antonio River is a cut terrace on a shale bedrock surface. Northwest of the San Antonio River in the vicinity of Lockwood is a structurally depressed basin, the Lockwood Ground Water Basin. The eastern boundary of the Fort parallels the western margin of the Lockwood Ground Water Basin.

The primary source of large quantities of ground water in this area is from the Paso Robles Formation. The Paso Robles varies in extent and thickness, with the maximum thickness of 3282 meters (1000 feet) northwest of the San Antonio Valley. The Older Alluvial terraces and Recent Alluvium are the only other significant sources of ground water. Shallow wells in these materials are subject to seasonal variation and some are seasonally dry.

There are 20 wells, 15 with pumping stations and 12 currently capable of water production. Two wells, 14(236) and 20(380), provide most of the water consumed, or approximately 29,994,581 liters (7,924,000 gallons) per month. The main water storage facilities include a 3,785,000-liter (1,000,000-gallon) reservoir and a 227,000-liter (60,000-gallon) steel tank. Smaller storage tanks are co-located with many of the smaller wells.

Water quality of wells providing the main supply is generally good; water from other wells varies from well to well. Shallow wells in alluvium are of poorer quality. Several wells are high in calcium, total dissolved solids, or sulfur. One well (Tule 2), high in sulfur, is used only for showers, etc. Water is naturally fluoridated and chlorination is the only treatment provided.

There are presently no plans to develop ground water resources. The Paso Robles Formation in the Lockwood Ground Water Basin is the only potential source of large quantities of good ground water. The geology of the Basin should be carefully studied for potential well locations. Variations occur within the Paso Robles and faulting appears to control ground water recharge. Future wells in the Paso Robles would be relatively deep, up to 339 meters (1,000 feet). Standard drilling, testing, and development procedures should be used.

There are approximately 40 known springs scattered throughout the Fort. Springs vary widely in quantity and quality of water. None of the springs has been developed or utilized except where water is held in catchments for fire fighting or for watering animals.

2. GROUND WATER (Continued)

MAP UNIT	QUANTITY AND SOURCE	DEPTH	QUALITY	DEVELOPMENT OF SOURCES
1	Very Large* quantities available from thick sedimentary deposits. Greatest yield in the vicinity of Lockwood. Yield varies due to folding and faulting of deposits. Average potential daily yield per well, based on well 20 (380), is approximately 2,543,520 liters (672,000 gallons) per 8-hour day. Yield from shallow wells is significantly smaller. Safe drawdown has not been defined for this basin. In nearly 20 years of heavy pumping for irrigation the water table has not been significantly lowered. Drawdown in well 20 (380) was 5.3 m (17.5 ft) when pumped for 23 hours at 5300 liters (1400 gallons) per minute. Water level rebounded to 2.1 m (7 ft) in 30 minutes. Rebound is equally rapid in all wells. Hydraulic continuity should exist between wells in proximity. Hydraulic continuity in more widely spaced wells could be affected by faulting or lateral variation within the material. Water in this unit is derived from poorly to well consolidated lower Pleistocene Paso Robles sandstone, sand, gravel, and siltstone. Stratigraphically this material varies greatly. Perforations in casings are set to coincide with sands and gravels with higher porosity and permeability.	Wells range in depth from approximately 23 m (75 ft) to 167 m (550 ft). Depth of wells varies with the thickness of the Paso Robles and the overlying Older Alluvium, Recent Alluvium, or both. Deeper wells normally provide higher yield.	Chemical data indicate that water in this unit is generally good. Wells are low in iron, manganese, and total dissolved solids. Water is slightly alkaline with pH in most wells between 7.2 and 7.8. Water is naturally fluoridated and chlorination is the only treatment required.	Ground water development at Fort Hunter Liggett is controlled by the geology of the area. The Paso Robles Formation and Older Alluvium in the area northwest of the San Antonio River provide up to 305 m (1000 ft) of potentially highly productive sedimentary material. Potential yields of 3785 liters (1000 gallons) to 9463 liters (2500 gallons) per minute could be expected. Ground water recharge should be adequate to sustain yields. Ground water storage should be adequate to allow for long periods with little or no recharge. Wells will be relatively deep, ±152 m (500 ft). Electric logs and standard completion and testing procedures should be used.
2	Moderate to small quantities available from Older Alluvial terraces. Yield from this material varies with thickness, areal extent, and topographic position. Material is moderately permeable and wells yield 378.5 to 1136 liters (100 to 300 gallons) per minute. Terraces are composed of poorly consolidated sand, gravel, and sandstone. Water table is normally relatively shallow ranging from 3 m (10 ft) to 15 m (50 ft) with seasonal variation. Drawdown can be relatively rapid due to mode of recharge and limited storage capacity.	Thickness ranges up to 61 m (200 ft). Wells range in depth from very shallow, 3 to 6 m (10 to 20 ft) up to 29 m (95 ft) below the surface. Yield varies with depth of wells.	Water quality is generally good; however, shallow wells are subject to biological or chemical contamination, depending upon the source of recharge.	Older Alluvium is a source of good ground water for bivouac areas, etc. Existing wells provide adequate quantities for present requirements. Limited quantities available preclude development of this material as a major source of ground water for Fort Hunter Liggett.
3	Small to meager quantities available from Recent Alluvium. Well yields vary with thickness of alluvial material and source of recharge. Maximum yield is approximately 40 liters (11 gallons) per minute. Alluvium consists of unconsolidated highly permeable, coarse gravels, sands, and silts. Subject to high seasonal variation.	Wells normally shallow; thickness of unit extremely variable with a maximum less than 30 m (100 ft).	Water quality varies with source of recharge. Well 17 (Tule 2) high in sulfur. Subject to biological or other contamination due to the shallowness of the water table and high porosity and permeability.	Small quantities available, seasonal variation, and potential for contamination make this a very poor unit for development as a ground water source.
4	Essentially a non-water-bearing unit. Meager amounts available in fracture zones. Rock consists of thick consolidated marine and continental sand, sandstone, siltstone shale, volcanics, and intrusive igneous rocks.	Depth varies with extent of fracture zone and quantity of recharge. No producing wells at Fort Hunter Liggett derive water from this unit.	Water quality from this unit is poor. Water can be high in iron, calcium, sulfur, or total dissolved solids.	Limited quantity and poor quality water at this unit preclude consideration of this unit as a source of significant quantities of water.

*Definitions of underlined terms are as follows:

	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Very large	4,000 - 40,000	1,500,000 - 15,000,000
Large	400 - 4,000	150,000 - 1,500,000
Moderate	40 - 400	15,000 - 150,000
Small	4 - 40	1,500 - 15,000
Meager	Less than 4	Less than 1,500

USER NOTE: For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM5-700, July 1967, Paragraph 19, or other applicable manuals or regulations.

PRODUCTION WELL DATA, 1977

WELL NUMBER*	LOCATION GRID REFERENCE	DEPTH meters	DEPTH (feet)	MAXIMUM DAILY CAPACITY liters (000)	MAXIMUM DAILY CAPACITY gallons (000)	AVERAGE DAILY PRODUCTION liters (000)	AVERAGE DAILY PRODUCTION gallons (000)	REMARKS
1 (201)	529919	11	(35)	36.3	9.6	intermittent production		Dry in summer
2 (201B)	529918	no data		36.3	9.6	"	"	Not in use
3 (203)	641896	37	(120)	18.1	4.8	"	"	
4 (203A)	643890	27	(87)	81.8	21.6	"	"	
5 (206)	577867	22	(73)	90.8	24.0	"	"	Not in use
6 (207)	596836	24	(80)	63.6	16.8	"	"	Not in use
7 (210)	647822	5	(17)	63.6	16.8	"	"	
8 (211)	677812	37	(120)	63.6	16.8	"	"	
9 (212)	639812	30	(98)	36.3	9.6	"	"	Not in use
10 (213)	644818	no data		272.5	72.0	"	"	At Miller Ranch
11 (216)	649711	51	(168)	54.5	14.4	"	"	
12 (219)	628840	6	(19)	no data		"	"	Not in use
13 (222)	586859	22	(73)	236.2	62.4	236.2	62.4	Headquarters Area
14 (236)	577861	30	(100)	908.4	240.0	908.4	240.0	
15 (Milpitas 2)	646871	52	(170)	408.8	108.0	intermittent production		
16 (Tule 1)	728746	48	(156)	no data		"	"	Not in use
17 (Tule 2)	728748	43	(140)	272.5	72.0	"	"	High sulfur-not used for drinking
18 (216A)	649708	no data		no data		"	"	Not in use
19 (204)	578878	no data		181.7	48.0	"	"	Not in use
20 (380)	658812	168	(550)	2543.5	672.0	2543.5	672.0	
			TOTALS	5368.5	1418.4	3688.1	974.4	

*Number in parentheses is Fort Hunter Liggett designator.

2. GROUND WATER (Continued)

WATER QUALITY, FORT HUNTER LIGGETT, CALIFORNIA

CONSTITUENT	UNIT OF MEASURE*	WELL NUMBER AND DATE OF SAMPLE** 1(201)	2(201B)	3(203)	4(203A)	8(210)	11(213)	12(216)	14(222)	15(236)	16(Mil.2)	Distribution System
		MAR 76	Dec 75	Dec 75	Dec 75	Mar 76	Mar 76	Mar 76	Mar 76	Mar 76	Oct 74	Mar 76
Alkalinity (as CAC03)	mg/1	149.00	140.00	276.00	141.00	242.00	127.00	412.00	236.00	122.00	164.00	120.00
pH		7.68	7.70	7.60	6.80	7.76	7.68	8.05	7.59	7.82	7.30	7.35
Hardness (total as CAC03)	mg/1	190.00	194.00	632.00	400.00	204.00	156.00	225.00	278.00	143.00	387.00	147.00
Calcium	mg/1	50.80	49.00	78.20	64.90	61.00	42.70	53.40	78.70	37.70	106.00	36.30
Potassium	mg/1	2.10	1.52	1.00	1.08	1.30	1.10	5.60	1.00	1.20	1.00	1.50
Silica	mg/1	23.70	23.40	37.60	45.00	25.00	31.30	18.30	44.00	38.20	43.50	38.00
Specific conductance	μ mhos	449.00	435.00	1300.00	920.00	556.00	387.00	1090.00	613.00	384.00	903.00	380.00
Total dissolved solid	mg/1	274.00	349.00	1027.00	794.00	343.00	244.00	624.00	406.00	242.00	594.00	248.00
Langlier index (corrosive)		–0.09267	–0.137	0.127	–0.998	0.26059	–0.22816	0.65545	0.17121	–0.159	–0.19	–0.65458
Color		<5.00	0.00	0.00	0.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00	<5.00
Fluorides	mg/1	0.47	0.30	0.49	0.22	0.24	0.26	0.86	0.22	0.31	0.21	0.41
Iron	mg/1	0.80	<0.10	9.99	0.205	0.35	<0.03	<0.03	0.152	<0.03	0.05	<0.03
Magnesium	mg/1	14.70	16.50	24.40	26.80	12.40	12.70	23.30	19.60	12.90	29.00	13.20
Manganese	mg/1	<0.01	<0.03	0.054	<0.03	<0.01	<0.01	0.145	<0.01	<0.01	0.01	<0.01
Chlorides	mg/1	7.90	8.70	38.50	39.00	27.60	8.90	44.40	16.90	12.70	86.00	15.40
Sulfates	mg/1	74.00	58.00	370.00	207.00	13.30	52.00	100.00	78.50	32.50	173.00	31.00
Arsenic	mg/1	<0.30	0.00	0.00	0.00	<0.03	<0.03	<0.03	<0.03	<0.03	<0.01	<0.03
Barium	mg/1	<0.20	<0.30	<0.30	<0.30	<0.20	<0.20	<0.20	<0.20	<0.20	<0.30	<0.20
Boron	mg/1	0.10	0.00	0.17	0.17	<0.13	0.10	1.62	0.15	<0.10	0.14	0.11
Cadmium	mg/1	<0.001	<0.005	0.012	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	<0.001
Chromium	mg/1	<0.01	<0.025	<0.025	<0.025	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	mg/1	<0.01	<0.025	<0.025	<0.025	0.189	<0.01	<0.01	<0.01	<0.01	0.01	0.203
Lead	mg/1	<0.01	<0.005	0.016	0.006	<0.013	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	mg/1	0.002	<0.002	<0.002	<0.002	<0.0002	<0.002	<0.002	<0.002	0.005	0.0004	0.0003
Nitrate (as nitrogen)	mg/1	<0.45	0.00	1.60	0.79	<0.04	<1.04	<0.04	1.70	0.98	1.70	4.70
Silver	mg/1	<0.01	<0.025	<0.025	<0.025	<0.01	<0.01	<0.1	<0.01	<0.01	0.01	<0.01
Sodium	mg/1	17.00	13.40	27.10	15.90	37.20	15.10	165.00	25.70	18.20	42.00	18.70
Zinc	mg/1	0.048	<0.015	3.601	0.061	0.52	<0.01	0.138	0.058	0.017	0.08	<0.01
Gross Alpha	PC/1	<1.10	<0.40	5.10	4.00	2.00	0.60	<0.70	1.10	<0.70	4.50	--
Gross Beta	PC/1	2.40	1.30	12.10	5.40	3.70	1.40	3.20	<0.70	1.20	4.80	--
Tritium	micro curie/1	0.0011	0.009	0.0009	0.008	0.0008	0.005	0.0005	0.0005	0.006	<0.10	--

* mg/1 = milligrams per liter; μ mhos = micromhos; PC/1 = Pico Curies per liter.

** Data not available for wells 5(206), 6(207), 8(211), 9(212), 12(219), 16(Tule 1), 17(Tule 2), 18(216A), 19(204), 20(380).

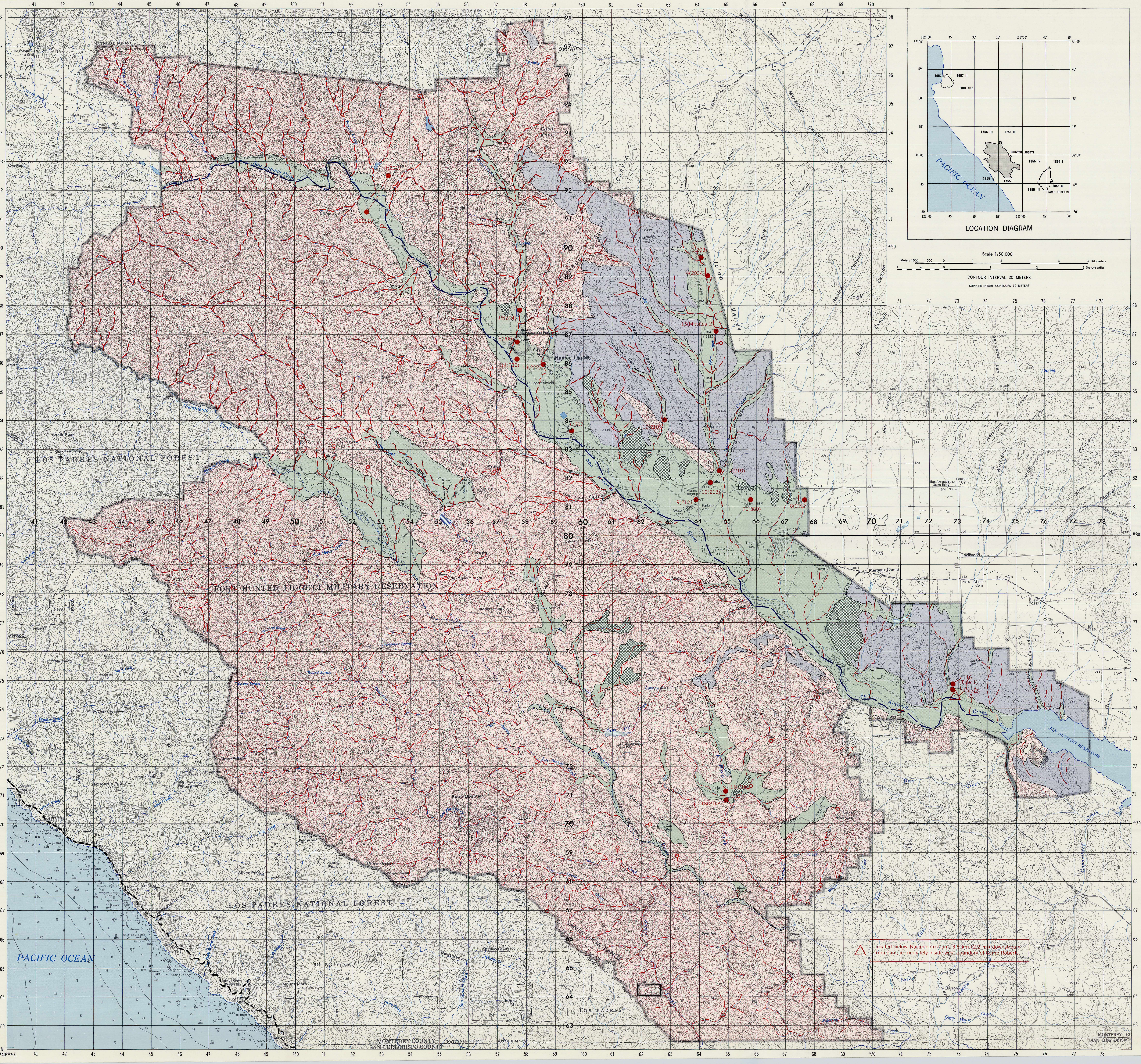
ZONES OF PERFORATIONS

DEPTH meters	(feet)	LENGTH meters	(feet)
60.0–65.5	(197–215)	5.5	(18)
69.8–73.1	(229–240)	3.4	(11)
85.9–89.6	(282–294)	3.7	(12)
110.3–114.9	(362–377)	4.6	(15)
125.2–131.0	(411–433)	6.7	(22)
136.2–143.8	(447–472)	7.6	(25)
154.5–162.7	(507–534)	8.2	(27)

Drillers: Fred Ash and Sons, Salinas, CA.
Casing: 39.6 m (130 ft) perforated and 128 m (420 ft) non-perforated 20.3 cm (8 in) diameter steel casings.
Perforations: factory cut ⅛ by 7.6 cm (3 in) milled slot on a standard spiral pattern with 48 perforations per linear foot.
Depth: Hole cemented in up to the 168 m (550 ft) level because of brackish water below that level.

REPRESENTATIVE DRILLING AND CASING LOG, PASO ROBLES GEOLOGICAL FORMATION WELL 20 (380)

DEPTH meters	(feet)	LENGTH meters	(feet)	DESCRIPTION
0.2–0.5	(0.5–1.5)	0.3	(1.0)	Slope wash and alluvium, sandy clay, dark brown, saturated.
0.5–5	(1.5–16.4)	4.5	(14.9)	Sand, brown to tan, fine- to medium-grained, slightly clayey.
5.0–15.1	(16.4–49.6)	10.1	(33.2)	Sand and gravel, brown to tan, medium- to coarse-grained sand and gravel to 3 inches; gravel is chert, quartz and shale.
15.1–16.2	(49.6–53.1)	1.1	(3.5)	Sand, brown to tan, fine- to medium-grained, slightly clayey.
16.2–19.8	(53.1–65.1)	3.7	(12.0)	Sand and gravel, tan to brown, medium- to coarse-grained sand, gravel to 3 inches; slightly clayey.
19.8–21.0	(65.1–68.8)	1.1	(3.7)	Sandy clay, brown, stiff.
21.0–36.4	(68.8–119.3)	15.4	(50.5)	Sand, brown to tan, fine- to coarse-grained, slightly clayey and occasional trace of fine gravel.
36.4–43.0	(119.3–141.1)	6.6	(21.8)	Gravelly sand, tan, fine- to coarse-grained sand, gravel to 3 inches; slightly clayey.
43.0–52.0	(141.1–170.8)	9.0	(29.7)	Sand, tan, fine- to medium-grained; slightly clayey.
52.0–55.2	(170.8–181.2)	3.2	(10.4)	Sand, tan, fine- to coarse-grained; occasional trace of fine gravel; slightly clayey.
55.2–65.6	(181.2–215.0)	10.3	(33.8)	Sand, tan, fine- to medium-grained; slightly clayey.
65.6–67.7	(215.0–222.0)	2.1	(7.0)	Gravel, tan, fine- to coarse-grained.
67.7–69.6	(222.0–228.5)	2.0	(6.5)	Sand, tan, fine- to medium-grained; slightly clayey.
69.6–74.5	(228.5–244.4)	4.8	(15.9)	Gravelly sand, tan, fine- to coarse-grained sand.
74.5–75.7	(244.4–248.4)	1.2	(4.0)	Clayey sand, tan, fine- to medium-grained.
75.7–78.7	(248.4–258.4)	3.1	(10.0)	Sand, tan, medium-grained, slightly clayey.
78.7–80.8	(258.4–265.1)	2.0	(6.7)	Clayey sand, tan, medium- to coarse-grained.
80.8–81.2	(265.1–266.6)	0.5	(1.5)	Gravel, tan, fine- to coarse-grained; slightly clayey.
81.2–81.4	(266.6–267.1)	0.2	(0.5)	Clayey sand, tan, medium- to coarse-grained.
81.4–83.5	(267.1–274.1)	2.1	(7.0)	Sand, tan, medium- to coarse-grained; slightly clayey.
83.5–84.4	(274.1–277.1)	0.9	(3.0)	Sandy clay, dark brown, medium- to coarse-grained sand.
84.4–86.9	(277.1–285.1)	2.4	(8.0)	Clayey sand, tan, medium- to coarse-grained, subangular quartz and chert fragments.
86.9–88.7	(285.1–291.1)	1.8	(6.0)	Sandy clay, brown, fine- to medium-grained sand.
88.7–95.4	(291.1–313.0)	6.7	(21.9)	Clayey sand, brown, fine- to medium-grained; occasional ¼-inch fragment of light gray siltstone.
95.4–101.6	(313.0–333.5)	6.3	(20.5)	Sandy clay, brown; fine- to medium-grained sand.
101.6–104.7	(333.5–343.5)	3.0	(10.0)	Sand, brown, fine- to medium-grained; slightly clayey.
104.7–112.1	(343.5–368.0)	7.5	(24.5)	Clayey sand, tan, fine- to medium-grained.
112.1–112.7	(368.0–370.0)	0.6	(2.0)	Sandy clay, green; fine- to medium-grained sand.
112.7–119.2	(370.0–391.3)	6.5	(21.3)	Sand, green, fine- to medium-grained fragments of chert and quartz that are subangular to subrounded; slightly clayey.
119.2–128.3	(391.3–421.1)	9.1	(29.8)	Clayey sand, brown, fine- to medium-grained.
128.3–131.1	(421.1–430.1)	2.7	(9.0)	Sandy clay, brown, fine- to coarse-grained sand.
131.1–135.2	(430.1–443.8)	4.1	(13.7)	Sand, brown, fine- to coarse-grained; slightly clayey.
135.2–136.5	(443.8–447.8)	1.2	(4.0)	Sandy clay, brown, fine- to coarse-grained sand.
136.5–152.3	(447.8–499.9)	15.9	(52.1)	Sand, brown, fine- to coarse-grained; slightly clayey.
152.3–164.9	(499.9–541.0)	12.5	(41.1)	Clayey sand, green, fine- to coarse-grained. Some of fine grains are subrounded quartz.
164.9–167.0	(541.0–548.0)	2.1	(7.0)	Clayey sand, brown, fine- to medium-grained.
167.0–187.6	(548.0–615.7)	20.6	(67.7)	Sand, green, fine- to coarse-grained; slightly clayey.
187.6–198.7	(615.7–652.1)	11.1	(36.4)	Clayey sand, green, fine- to medium-grained sand.
198.7–203.5	(652.1–667.9)	4.8	(15.8)	Sandy clay, green, fine- to medium-grained sand.
203.5–208.1	(667.9–682.9)	4.6	(15.0)	Clayey sand, green, fine- to medium-grained.
208.1–214.0	(682.9–702.2)	5.9	(19.3)	Clay, brown, plastic; occasional fine- to medium-grained sand.
214.0–239.0	(702.2–784.2)	25.0	(82.0)	Clay, brownish green, plastic.
239.0–242.0	(784.2–794.2)	3.1	(10.0)	Siliceous shale or chert, olive green to black, very hard, cryptocrystalline.
242.0–243.2	(794.2–798.0)	1.2	(3.8)	Shale or clay, dark green, very soft.



HUNTER LIGGETT, CALIFORNIA TERRAIN ANALYSIS

WATER RESOURCES

SURFACE WATER

FRESH WATER PERENNIALLY PLENTIFUL

1. Large* quantities available from the San Antonio River throughout the year, greatest from January to April.
2. Moderate quantities available from the Nacimiento River during the dry season (May to December) and very large quantities available during the wet season. Nacimiento River has less flow than San Antonio River during dry season but greater flow during wet season.

FRESH WATER SCARCE

3. Small and meager quantities available from small tributary streams generally less than 0.5 km (0.3 mi) apart, frequently dry; may have continuous small trickle in wet periods; only representative streams mapped.

U.S. Geological Survey Gauge Station

GROUND WATER

FRESH WATER GENERALLY PLENTIFUL

1. Very large* to large quantities available from thick, poorly to well consolidated sand, gravel, sandstone, siltstone and conglomerate.

FRESH WATER LOCALLY PLENTIFUL

2. Moderate to small quantities available from thin, poorly consolidated sand, gravel and sandstone.
3. Small to meager quantities available from very thin coarse gravel, sand and silt.

FRESH WATER SCARCE OR LACKING

4. Meager quantities available from fracture zones in thick, well consolidated marine and continental sand, sandstone, siltstone shale and volcanic rocks.

NOTE: Number refers to entry in table.

1(201) Well (number in parentheses is Fort Hunter Liggett designator)

Spring (no data available)

*Definitions of underlined terms are as follows:

	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Enormous	>40,000	>15,000,000
Very large	4,000—40,000	1,500,000—15,000,000
Large	400—4,000	150,000—1,500,000
Moderate	40—400	15,000—150,000
Small	4—40	1,500—15,000
Meager	<4	<1,500

USERS NOTE: For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM 5-700, July 1967, paragraph 19, or other applicable manuals or regulations.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

D. ENGINEERING SOILS

SOIL CHARACTERISTICS AND SELECTED EVALUATIONS

Generalized engineering soils data shown on the map and in the table have been adapted from a detailed soil survey report of Monterey County, California. Information presented here is necessarily generalized but should be helpful for general planning for land use or construction activities. For information on a specific site, or otherwise small area, an on-site field survey and testing is required.

Soils on Fort Hunter Liggett are predominately sands and sand mixtures that have been developed in place from a variety of rock types. Soil depths vary from nil in Map Unit 6 to many meters thick in the alluvial deposits of Map Unit 1. However, most are less than about 40 cm (16 in) deep.

Due to topography of the area, most of the soils are unaffected by a seasonal high water table, although some low-lying areas along major streams are occasionally flooded. Runoff after rains is fairly rapid because of the steep topography and shallowness to rock.

Soils on the Fort are predominately alkaline, but range from acid (ph 5.1) to alkaline (ph 8.4). Salinity of the soils is less than 2μ mhos per centimeter and natural fertility is low. Organic matter content of the soil is low which is typical for the area.

Generally, soils grouped in Map Unit 3 and 4 are best suited for construction and engineering purposes whereas soils grouped in Map Unit 1 and 6 are least suited.

Typical soil profile diagrams are shown for each map unit. These diagrams depict the representative composition and sequence of layers of the dominant soils within the map unit. Estimated thickness of layers is indicated in centimeters.

For more comprehensive information concerning kinds, distribution and properties of Fort Hunter Liggett soils, the user of this terrain study should seek the assistance of the Soil Conservation Service, U.S. Department of Agriculture, Santa Maria or Paso Robles, California.

MAP UNIT	MAJOR SOIL SERIES 1/	GEOGRAPHIC SETTING	TYPICAL SOIL PROFILE — layers, thickness and color of layers, depth to rock and Unified engineering classification 2/ (Profile diagram not to scale).	HIGH-WATER TABLE- depth (meters) and duration (months)	PERMEABILITY- centimeters/hour or (inches/hour)	SHRINK-SWELL POTENTIAL	RATING AND MAJOR KINDS OF LIMITATIONS FOR: SEWAGE LAGOONS	SEPTIC TANK FILTER FIELDS	FOUNDATIONS FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATIONS	TRAFFIC-ABILITY	BIVOUAC SITES	REMARKS
1	—	Soils that occur in stream and river channels; 0–3 percent slope.	cm: SM, SP, GP to 180+ — Water-deposited sandy, gravelly, cobbly and stony sediments randomly distributed.	Subject to flooding after rains (Nov to Mar.)	Greater than 15.0 cm/hr (Greater than 6.0 in/hr	Low	Severe (f) (s)	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Severe (f) Moderate when dry (c)	Severe (f)	Soils in this unit are undesirable for construction sites but are a good source for sand and gravel. Map unit covers about 68 km^2 (16,644 acres).
2	Cieneba Sheridan San Andreas	Hills, uplands and mountains with 30–75 percent slope. Many rock outcrops with shallow soils over either weathered or unweathered bedrock.	cm: SM 0–38 — Gravelly sandy loam. Bed-rock 38–180+ — Weathered and unweathered granites and sandstones.	None	5.0–15.0 cm/hr (2.0–6.0 in/hr)	Low	Severe (h) (r) (s)	Severe (h) (r)	Moderate (h) (r)	Severe (h)	Severe (r)	Severe (h)	Moderate (h)	Soils in this unit are primarily in upland areas and are formed in place from hard unweathered sandstone or deeply weathered granites. Map unit covers about 261 km^2 (64,918 acres).
3	Arroyo Seco	Nearly level to moderately sloping alluvial fans and plains. Slopes range from 0–5 percent. Soils developed from old alluvial deposits.	cm: SM 0–102 — Gravelly sandy loam. GM 102–180+ — Very gravelly coarse sandy loam.	Low areas near streams subject to flooding after rains (Nov to Mar). Other areas more than 1.8 m.	5.0–15.0 cm/hr (2.0–6.0 in/hr)	Low	Severe (s)	Severe (s)	Slight	Slight	Slight	Slight	Slight	Best unit for overall engineering use. Soils of this series are suited for irrigated field crops, orchards and vineyards. Map unit covers about 48 km^2 (11,664 acres).
4	Salinas Sorrento	Nearly level to moderately sloping floodplains and alluvial fans. Slopes range from 0–9 percent. Soils developed from stream alluvium.	cm: CL 0–63 — Grayish-brown clay loam. CL 63–180+ — Brown friable clay loam.	Low-lying areas subject to flooding after rains (Nov to Mar).	0.5–1.5 cm/hr (0.2–0.6 in/hr)	Low to Moderate	Slight	Slight	Moderate (a) (h) (t)	Severe (a) (t)	Moderate (m)	Slight when dry Moderate when wet (f)	Slight	Soils in this unit are in valleys and flood plains. They can be used for dryland crops or irrigated row crops. Runoff is medium to slow with a slight erosion hazard. Map unit covers about 88 km^2 (21,664 acres).
5	Santa Lucia Reliz	Steep to very steep upland soils with a slope of 30–75 percent. Soils formed in place from fractured shale.	cm: GM, CL 0–30 — Pale brown shaly clay loam. Bed-rock 30–180+ — Unweathered fractured shale.	None	1.5–5.0 cm/hr) (0.6–2.0 in/hr)	Low	Severe (h) (r)	Severe (h) (r)	Severe (h)	Severe (h)	Severe (h) (r)	Severe (h) (r)	Moderate (h)	High erosion hazard due to rapid runoff. Unit covers about 128 km^2 (31,644 acres).
6	—	Very steep to extremely steep hilly or mountainous areas. Slopes are commonly 60–75 percent. Rock commonly outcrops on 30 percent or more of the area. Seldom more than 25 cm (10 in) of soil over bedrock.	cm: SC, CL 0–13 — Brown granular loam. Bed-rock 13–180+ — Various type rock such as conglomerates, sandstone and shale.	None	Less than 0.15 cm/hr (Less than 0.06 in/hr)	Low	Severe (h) (r)	Severe (h) (r)	Severe (h) (r)	Severe (h) (r)	Severe (h) (r)	Severe (h)	Severe (h)	Soils in this unit are undesirable for construction sites because of steep slopes and rock outcrops. Areas within this unit are suitable for water-shed purposes but require protection from removal of vegetation. Map Unit covers about 81 km^2 (20,001 acres).

1/ Soils that have profiles almost alike make up a soil series. The series is the common name of the soil. Each series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Many other minor soils are included in the map unit. Soils are not identified for all map units.

2/ The Unified Soil Classification System, Technical Memorandum No. 3-357, U.S. Army Corps of Engineers, March 1953.

DEFINITIONS OF RATING TERMS

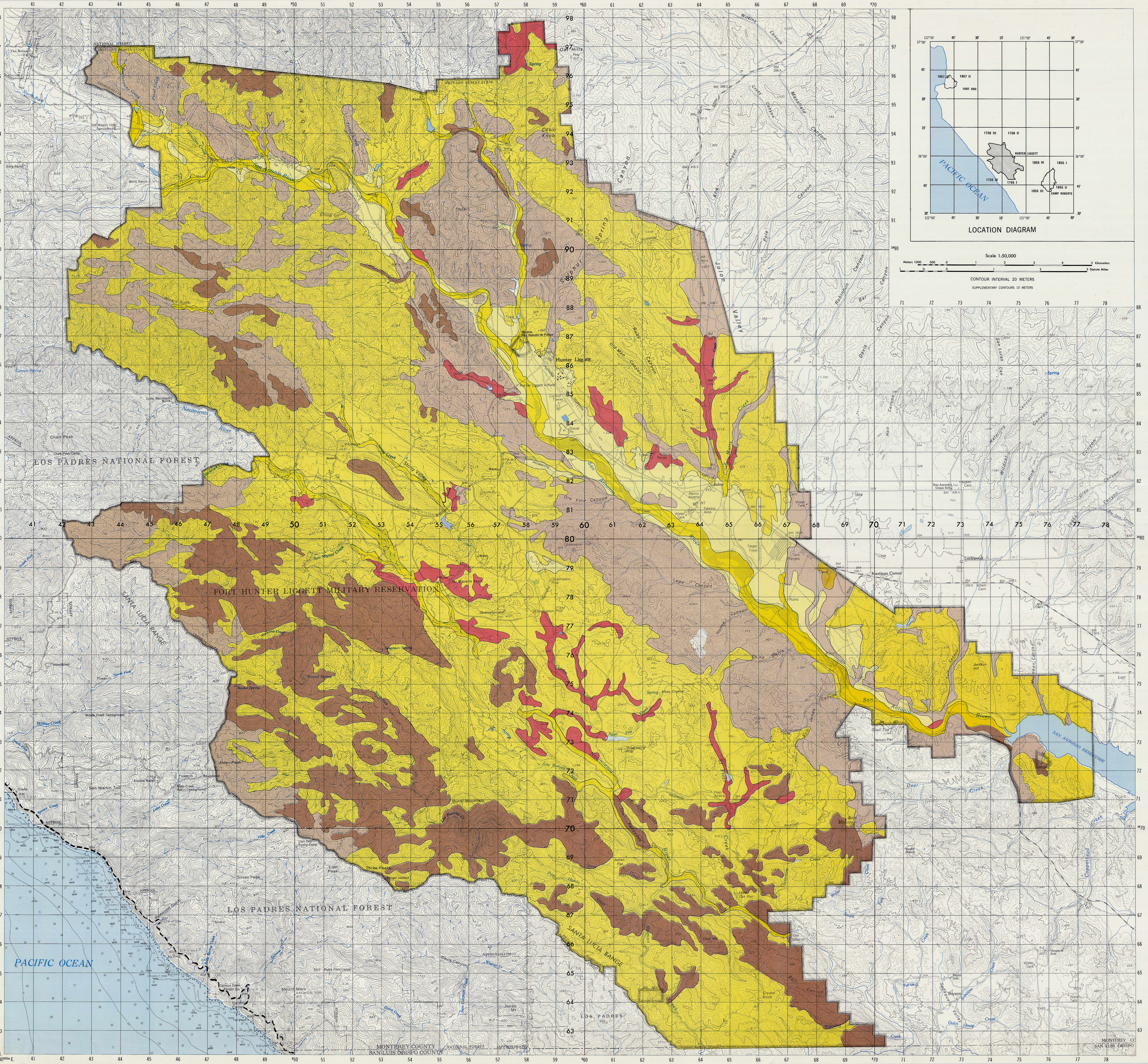
SLIGHT - relatively free of limitations or limitations are easily overcome.

MODERATE - limitations can be overcome with good planning and/or careful design.

SEVERE - limitations are serious and are difficult to overcome.

SOIL RELATED PROPERTIES AFFECTING LIMITATIONS

a - high shrink-swell	m - too clayey
c - rough surface	r - depth to rock
f - floods	s - seepage, porous soil
h - slope	t - low strength



HUNTER LIGGETT, CALIFORNIA TERRAIN ANALYSIS

ENGINEERING SOILS

COARSE-GRAINED SOILS

1 Alluvium consisting primarily of sand mixed with varying amounts of gravel and cobble soils randomly distributed.

2 Gravelly sandy loam on hills, uplands and mountains.

3 Gravelly sandy loam on alluvial fans and moderately sloping plains.

FINE-GRAINED SOILS

4 Clay loam developed from alluvium on flood plains and alluvial fans.

COARSE-AND FINE-GRAINED SOILS

5 Shaly clay loam on steep uplands developed from fractured shale.

6 Extensive rock outcrops with a very thin soil covering.

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

E. ENGINEERING GEOLOGY

Fort Hunter Liggett is in the California Coastal Ranges section of the Pacific Border physiographic province, about midway between the cities of San Luis Obispo and Monterey. The reservation is generally hilly; the only significant level area is in the San Antonio River valley. The major river valleys and many ridges have a distinct northwesterly alinement. Elevations range from 242 m (794 ft) at the San Antonio River to 1142 m (3744 ft) in the Santa Lucia Range at Alder Peak, near the southwestern boundary of the reservation. All drainages in the area are into the San Antonio and Nacimiento Rivers which flow southeast across the reservation, then easterly to join the Salinas River.

Rock types include recent alluvium in valleys, relatively recent conglomerates and sandstones of the Paso Robles Formation in the northeast, highly fractured sandstones and shales of the Franciscan Formation in the southwest, and metamorphic rocks in the northwest.

Most of the reservation is unsuited for engineering developments and many military operations because dissected, hilly terrain predominates. Level land and easy access is limited largely to the valley of the San Antonio River. Most of the rocks have good load-bearing capabilities, but where there are interbedded mudstones, weak shales, or highly fractured materials, the capability is diminished. There are many potential sources of materials for construction use — sand, gravel for aggregate, unconsolidated fill material, blocky bedrock for riprap; some building stone probably is available, and small amounts of exploitable resources such as gold, mercury, and asbestos.

Fort Hunter Liggett is in a region of active faulting and earthquake activity. See Section F. Special Physical Phenomena for detailed discussion.

Geological units on the accompanying map were delineated from aerial photo analysis and from U.S. Geological Survey maps. Unit boundaries are not precise.

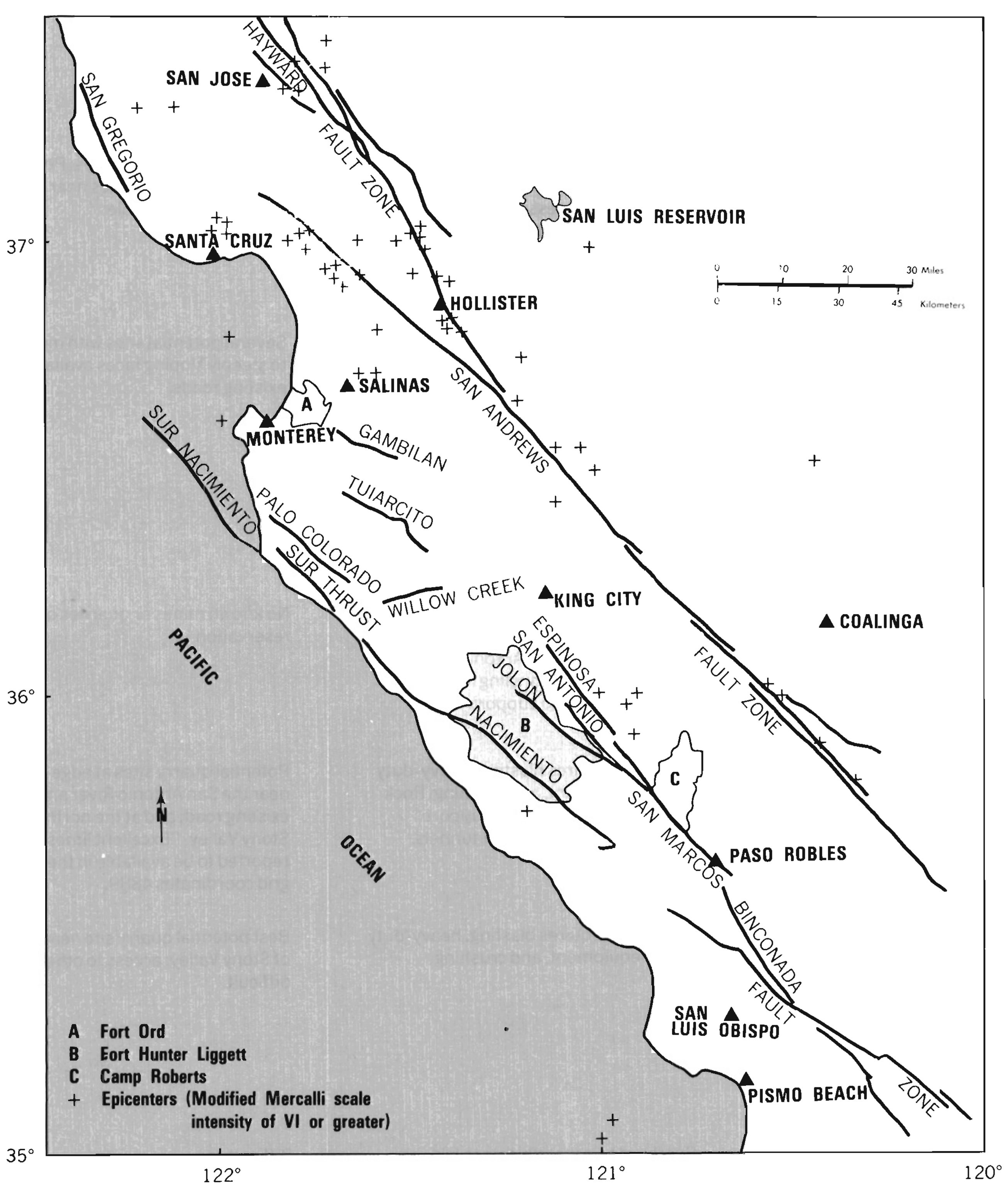
MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
1. Alluvium	Areas of low relief along the San Antonio River and in valleys and larger canyons of adjacent hills. Generally flat to rolling, except for small hillocks near the town of Jolon. Areas at mouths of streams tributary to larger rivers, and river floodplains subject to possible flooding during heavy rains.	Consists of two ages of alluvium, recent and older. Recent alluvium comprises unconsolidated sand and gravel of present stream channels. Older alluvium is principally poorly consolidated mudstone, pebbly mudstone and sandstone, and conglomerate, but consistency ranges from unconsolidated to well cemented. Older alluvium is massive or poorly bedded, less than 30 m (100 ft) thick, yellowish-gray to grayish-orange, and non-calcareous except where associated with caliche.	Porosity high to low; permeability moderate to high, but poor where caliche occurs. Moderate to no shrink-swell. Seismic velocity low.	Suitable for roads, airfields, and multi-structures emplacement; topographic alinements northwesterly. Easy access from existing roads. Load-bearing capability adequate for heavy structures and heavy-duty roads; area is, however, underlain by strong faults and may be subject to seismic disturbance. Sand and gravel available in stream channels. Flooding possible during heavy rains. Drainage good. Unsuited for disposal of liquid and solid wastes because high permeability may permit contamination of ground water.	Excavation very easy in stream channels, and generally easy throughout unit. Easy access from existing roads. Stability of materials poor to fair; supports required for vertical cuts and tunnels.	Sand and gravel borrow pit sites abundant in San Antonio River channel; many smaller sites locally in other stream channels.
2. Sandstone	A wide belt of strongly ridged, rugged hilly terrain extending northwesterly from the south-central boundary of the reservation to the north limit of Stony Valley; and scattered smaller areas across the northern part of the reservation. There are some relatively flat areas in the northern and central parts of the unit.	Principally massive to thick-bedded sandstone members, fine- to coarse-grained, friable to well cemented; color varies from white to gray-orange and brown. Interbedded shale, siltstone, and conglomeratic sandstone.	Sand grains angular to subrounded, 0.12 – 1.5 mm (0.004 – 0.06 in.) diameter. Porosity 2 – 15%. Specific gravity 2.5 – 2.6. Compressive strength 350 – 1480 kg/sq cm (5000 – 21,000 lb/sq in.)	Road alinements require cut-and-fill, or grades near constant elevations; occasional small areas suitable for small airfields. Load-bearing capability adequate for moderate to heavy structures. Shales exposed on slopes tend to ravel and reduce stability of sandstone in which they occur. Abundance of rock for road base or fill; some fine-grained, well cemented material suitable for building stone.	Excavation in well cemented materials requires blasting and power equipment. Stability of steep slopes good except where there are interbedded shales.	No known pits or quarries. Many potential sites near existing roads; rugged terrain limits access to other areas.
3. Mudstone and shale	A belt of hillocky terrain along the west side of the San Antonio River valley and east of a line from Stony Valley in the north to Bald Mountain in the south; a smaller area on both sides of Mission Creek in the northeastern part of the reservation. Terrain is well dissected; relief is in hundreds of feet.	Monterey Formation, composed of porcelaneous and calcareous mudstones and shales interbedded with sandstone, conglomerate, chert, and dolomitic carbonate rock; well weathered. Mudstone and shale predominant.	Porosity and permeability low. Moderate to high shrink-swell. High elasticity. Shears easily along bedding planes.	Generally poorly suited for large engineering development because of rugged terrain and possible instability of rock; road alinements require much cut-and-fill. Most of unit not readily accessible from existing roads. Possibility of slippage in wet shales under loads. Abundant material for fill; some of the shale may be suitable as building stone.	Excavation with normal power equipment in most areas; light blasting in some areas. Access from existing roads difficult; new-road construction difficult.	No known pits or quarries. Possibility of potential quarry sites near roads, if materials are suitable.
4. Conglomerate and sandstone	Dissected hillocky uplands east of the San Antonio River valley at the southeast corner of the reservation and north of Jolon nearly to the northeast reservation boundary. Relief is approximately 60 – 120 m (200 – 400 ft).	The Paso Robles Formation, composed chiefly of poorly bedded friable conglomerate, conglomeratic sandstone, and sandstone. Conglomerate contains pebbles, cobbles, and some boulders of various rock types. Most of the sandstone is of poorly sorted grain sizes. Mudstone locally common; limestone beds 0.3 – 0.9 m (1 – 3 ft) occur locally. Paso Robles Formation is more than 150 m (500 ft) thick.	Porosity and permeability moderate to high, but low in mudstone. Low shrink-swell, but high in mudstone.	Poorly suited to unsuited for most engineering development because of lack of level ground; road alinements require siting along canyons and much cut-and-fill. Load-bearing capability of most materials good. Stability of steep slopes fair; some support required in vertical cuts and tunnels. Good source of fill, road-construction material, and concrete and bituminous aggregate.	Excavation relatively easy with power equipment. Some support required for steep slopes. Access easy from existing roads.	Several potential sites with moderately to steeply sloping faces available near existing roads.
5. Sandstone and mudstone	Several small bodies outcropping from hillocks along the margins of the San Antonio River and Mission Creek valleys. Moderately to highly dissected.	Principally sandstone with some pebbly and diatomaceous mudstone; outcrops in the southeast near the reservoir range to impure diatomite. Sandstone generally massive to poorly bedded, white to light gray color.	Porosity 2 – 15%. Specific gravity about 2.5. Poissons ratio 0.17.	Limited extents of the unit make it suitable for few engineering uses. Access generally difficult, except easy adjacent to San Antonio River valley. Mining of low-grade diatomite possible, for use as insulation, filter material, or filler in dynamite.	Excavation requires use of power equipment. Access generally difficult, except easy adjacent to San Antonio River valley. Mining or tunneling in diatomite requires little or no support.	No known mines or quarries on the reservation.
6. Metamorphic rocks	Severely dissected high hills in the northwestern part of the reservation. Elevations range from about 400 m (1300 ft) at the San Antonio River to 1070 m (3508 ft) in the hills to the south.	Complex of weathered metamorphic rocks including schist, gneiss, marble, and quartzite; laced with small areas of granite and olivine gabbro.	Specific gravity 2.5 to more than 3.0. No shrink-swell. Poissons ratio 0.1 – 0.4. High compressive strength.	Rugged terrain and difficult access limit suitability for most engineering uses. Marble, gneiss, and quartzite potential sources of crushed stone and riprap, but difficulty of access restricts quarrying to edges of map unit.	Quarring requires blasting, heavy-duty power equipment, and crushing. Rock stability good; little or no support required in vertical cuts or tunnels.	Potential quarry sites at edge of unit near the San Antonio River and near existing road; and at the north end of Stony Valley. "Excellent limestone" reported to be available in the unit near grid coordinates 4889.
7. Granitic rocks	Small areas of deeply dissected hills in the northwestern and northermost parts of the reservation. Elevations range from about 488 m (1600 ft) to 1013 m (3323 ft).	Granitic rocks, mainly quartz monzonite; three westernmost bodies laced with metamorphic rocks.	Porosity less than 2%; permeability very low. Specific gravity 2.6 – 2.7. No shrink-swell. Poissons ratio 0.15 – 0.24. Compressive strength very high, to 9300 kg/sq cm (60,000 lb/sq in.).	Rugged terrain and difficult access make unit generally unsuited for engineering uses. Load-bearing capability high. Potential source of aggregate and riprap.	Quarrying requires blasting, heavy-duty power equipment, and crushing.	Best potential quarry site near south end of Stony Valley; access to other sites difficult.
8. Graywacke, shale, and conglomerate	Wide belt of highly dissected hills trending northwesterly along the entire southwest boundary of the reservation. Includes the Santa Lucia Range. Separated from map units to the east by the Nacimiento Fault line. Elevations range from about 533 m (1750 ft) to 1141 m (3742 ft).	Mixed, deeply weathered, deformed graywacke, shale and siltstone, conglomerate, mafic volcanic rocks, chert, and glaucophane schist; highly sheared and fractured.	Porosity and permeability very low. Good adhersion to tar. Characteristics vary greatly with rock types and degree of weathering.	Unsuited for most engineering uses because of steep slopes, limited existing access roads, and possibility of rock falls, landslides, and slippage along bedding planes.	Overburden generally thin to lacking. Excavation requires power equipment, and blasting in less fractured rock. Rock stability poor to moderately good. Some abandoned gold mines.	Difficult access and extreme relief restricts potential quarry sites to areas in the south near existing road.
9. Serpentine	Several separate small, remote, northwesterly trending bodies entirely within Unit 8. Unit comprises severely dissected hills and the steepest slopes on the reservation (at Los Burros Creek south of Burro Mountain). Elevations range from about 365 m (1200 ft) to 810 m (2661 ft).	Smaller bodies are thoroughly serpentinized; intense shearing has destroyed textures of the original rocks. Interiors of larger bodies consist of blocky serpentine. Burro Mountain mass is massive, fresh peridotite and dunite.	Hardness 2 – 5. Specific gravity 2.2 – 2.65.	Unsuited for most engineering uses because of steep slopes, difficult access, and slippery nature of serpentine rock. Some access near Salmon Creek. Unit is source for such minerals as chromite, mercury, manganese, gold, jade, and asbestos.	Excavation relatively easy with light blasting or cutting, and power equipment. There are some non-operational mines.	Difficult access restricts potential quarry sites to area near Salmon Creek.

F. SPECIAL PHYSICAL PHENOMENA

Fort Hunter Liggett is in a region of intense faulting, astride large faults such as the Nacimiento, Bee Rock, Jolon, and San Antonio. The reservation is also near an active portion of the San Andreas Fault system. Frequent earthquakes have been reported for the area. The Fort is in Zone 3 (possible major damage) of the Seismic Risk Zone map of the U.S. Geological Survey. Construction and military operations must recognize the likelihood of continuing earth movements.

Other hazards to military activities are the possibility of flash floods from mountain canyons during heavy rains, and of rock falls and landslides in the southwestern part of the reservation.

MAJOR FAULTS AND APPROXIMATE EPICENTERS OF EARTHQUAKES OF CENTRAL COASTAL CALIFORNIA THROUGH 1970



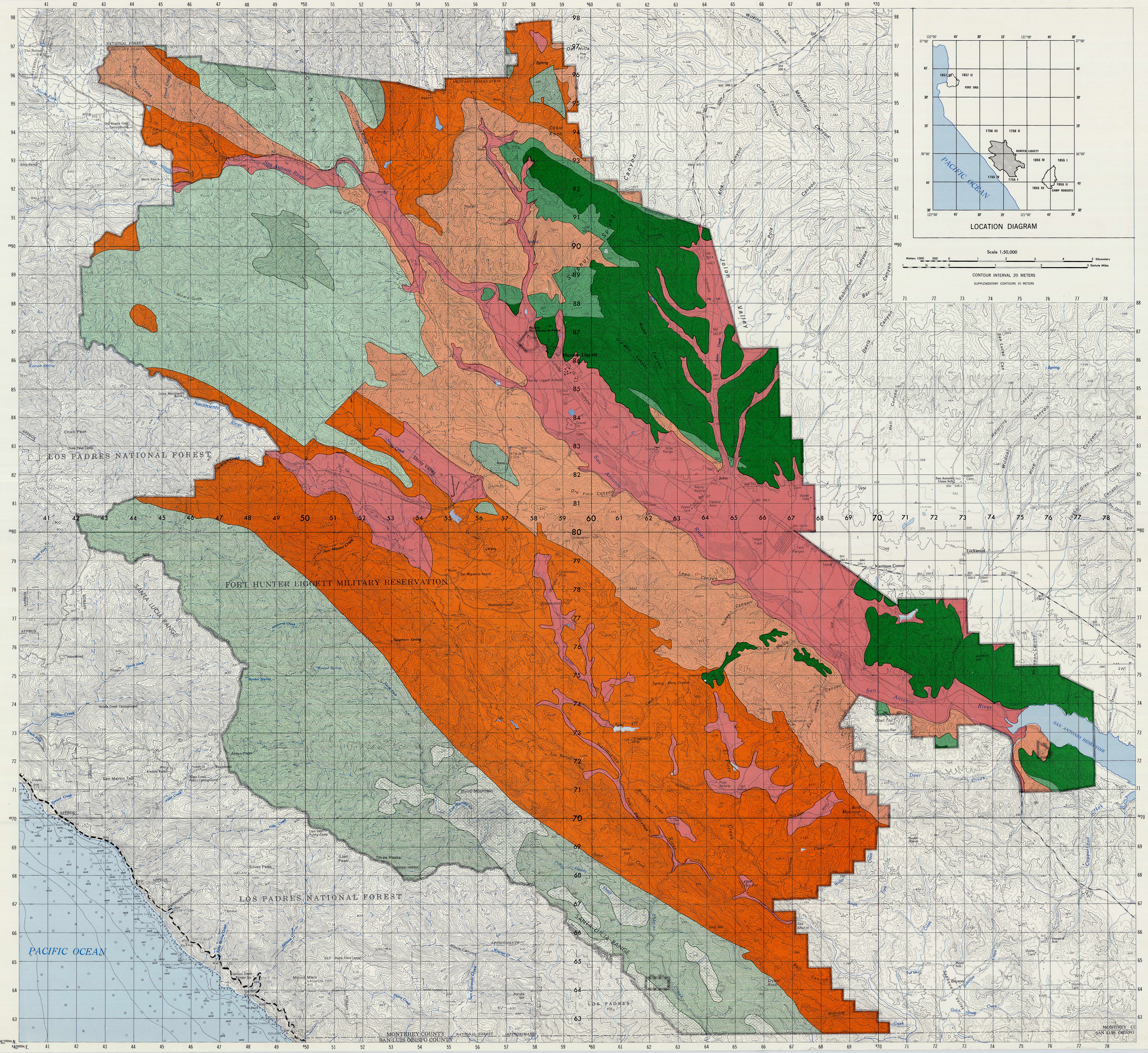
MAJOR FAULTS AND APPROXIMATE EPICENTERS OF EARTHQUAKES OF CENTRAL COASTAL CALIFORNIA THROUGH 1970

(Intensity of VI or Greater on Modified Mercalli Scale*)

YEAR	DATE	N. LAT	W. LONG	INTENSITY
1970	Jan. 2	37°18′	122°6′	VI
1969	Oct. 27	36°48′	121°24′	VI
1967	Dec. 18	37°0′	121°48′	VI
	Sept. 28	37°12′	121°36′	VI
	Sept. 7	37°0′	121°48′	VI
	July 22	36°30′	121°6′	VI
1966	Oct. 14	37°0′	121°48′	VI
	June 27	35°54′	120°54′	VII
1963	Sept. 14	36°48′	121°36′	VII
	May 22	37°18′	122°12′	VI
1961	Apr. 8	36°42′	121°18′	VII
1960	Jan. 19	36°48′	121°24′	VI
1959	Dec. 28	36°54′	121°30′	VI
	May 26	36°42′	121°36′	VI
	Mar. 2	37°0′	121°36′	VI
1958	Sept. 30	36°24′	121°6′	VI
1956	Nov. 15	36°0′	120°30′	VI
1955	Nov. 2	36°0′	120°54′	VI
	Sept. 4	37°24′	121°48′	VII
	Mar. 2	36°0′	120°54′	VI
1954	Sept. 15	37°18′	120°0′	VI
	Aug. 12	36°54′	121°42′	VI
	Aug. 22	36°54′	121°42′	VIII
	Mar. 19	36°54′	121°42′	VI
1953	Dec. 16	36°54′	121°42′	VI
1952	Nov. 21	35°48′	121°12′	VII
1951	Oct. 31	36°54′	121°24′	VI
	Aug. 6	36°36′	121°12′	VI
	July 29	36°36′	121°12′	VI

YEAR	DATE	N. LAT	W. LONG	INTENSITY
1949	June 9	37°24′	121°36′	VI
	Mar. 9	37°0′	121°30′	VII
1948	Dec. 31	36°54′	121°36′	VII
1947	Aug. 10	36°54′	121°24′	VI
	June 22	37°0′	121°48′	VI
1945	Aug. 27	37°18′	121°48′	VI
	May 17	36°48′	121°24′	VI
	Jan. 7	36°42′	121°12′	VI
1943	Oct. 25	37°24′	121°42′	VI
1939	June 24	36°48′	121°24′	VII
1934	June 7	36°0′	120°30′	VIII
1927	Nov. 18	35°0′	120°30′	VI
	May 28	37°18′	121°48′	VI
	Feb. 15	37°0′	122°0′	VI
1926	Oct. 22	36°45′	122°0′	VIII
	July 25	36°30′	120°30′	VI
1924	Dec. 27	36°42′	121°36′	VI
1922	Mar. 10	35°45′	120°15′	IX
1916	Dec. 1	35°0′	121°0′	VII
	Aug. 6	36°30′	121°0′	VII
1914	Nov. 8	37°0′	122°0′	VII
1911	July 1	37°0′	122°0′	VII – VIII
	Mar. 11	37°0′	121°0′	VI
1901	Mar. 2	36°0′	120°30′	VII – VIII
1899	Apr. 30	37°0′	121°30′	VII
1897	June 20	37°0′	121°30′	VIII
1892	Nov. 13	36°30′	122°0′	VI
1890	Apr. 24	37°0′	121°30′	VII
1885	Apr. 11	36°0′	121°0′	VII – VIII
	Mar. 30	36°30′	121°0′	VII
1883	Mar. 30	37°0′	122°0′	VI
1865	Oct. 8	37°0′	122°0′	VIII – IX
1852	Dec. 17	35°0′	121°0′	VII – VIII

*Note: Intensity of VI indicates lowest level of damage.
Intensity of IV indicates collapse of some structures.



HUNTER LIGGETT, CALIFORNIA TERRAIN ANALYSIS

ENGINEERING GEOLOGY

NUMEROUS ENGINEERING USES

1. Alluvium

SOME ENGINEERING USES

2. Sandstone
3. Mudstone and shale

FEW ENGINEERING USES

4. Conglomerate and sandstone
5. Sand stone and mudstone
6. Metamorphic rock

UNSUITED

7. Granite rock
8. Graywacke, shale and conglomerate
9. Serpentine

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

G. VEGETATION

Fort Hunter Liggett has three types of vegetative cover: forests, grasslands, and scrub. The location and extent of the three types are shown on the accompanying map. Details concerning each, including assessments of cover and concealment, are given in the table below. All three types of vegetation are significant in relation to military maneuvers and other training activities. In combination, they virtually cover the entire Hunter Liggett area.

Forests:

The forest cover is predominantly deciduous. Canyon live oak, blue oak, valley (California) white oak, California sycamore, and Fremont cottonwood are the dominant species. Digger pine, a coniferous tree, can also be found scattered throughout the area. Undergrowth varies from fairly open areas of grasses and forbs to dense patches of brush and scrub trees.

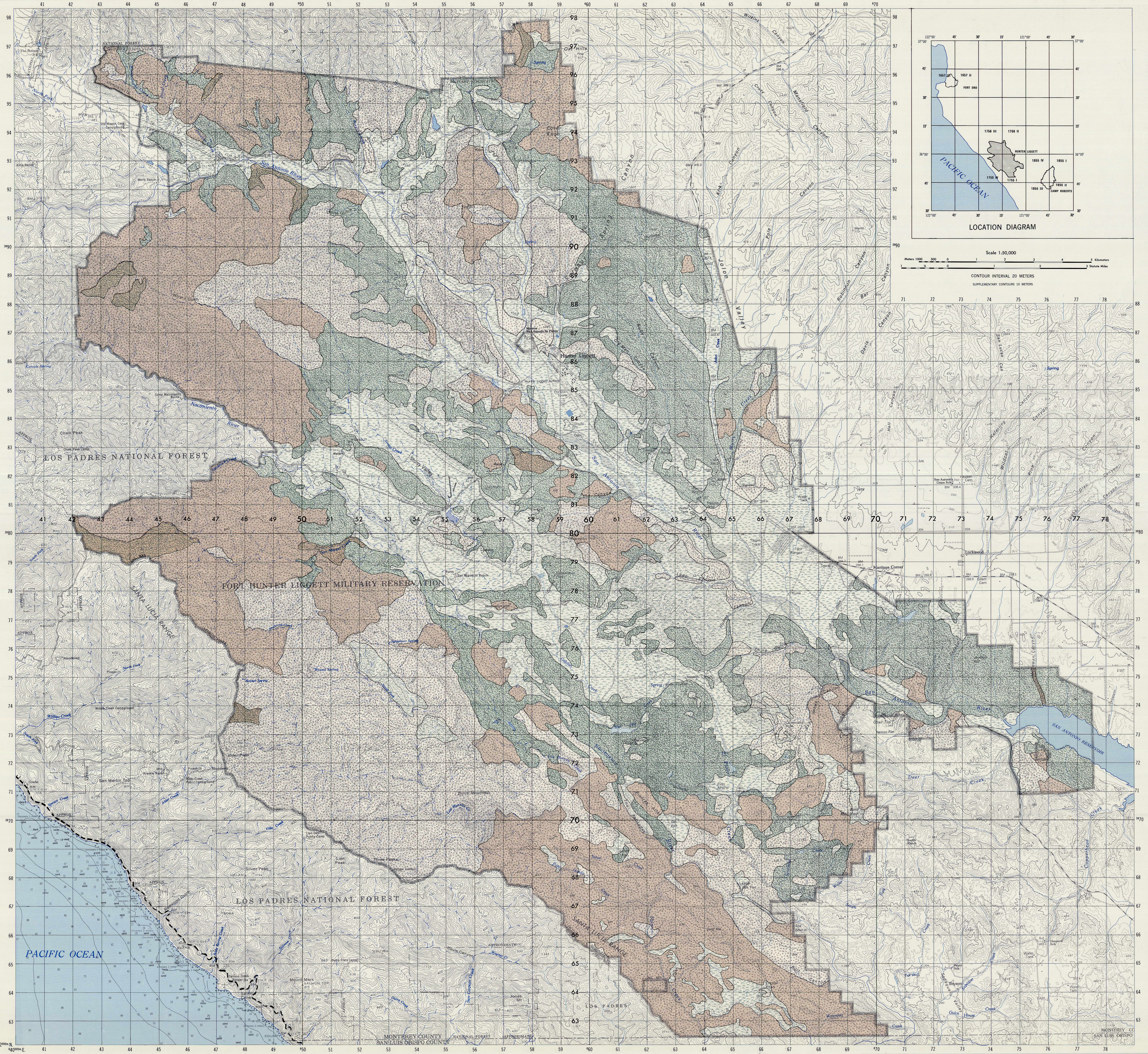
Grasslands:

Short grasses predominate, grass species include ryegrass, foxtail, and wild oats. Scattered trees, not exceeding 10% crown cover density, exist. This unit also includes bare ground areas usually associated with stream valleys and dry washes of larger stream beds.

Scrub:

Mixed deciduous and coniferous scrub covers approximately 45–50% of the area. Existing areas found on the western and southern sides of the fort. Scrub species include chaparral, manzanita, chamise, mountain mahogany, buckbrush, and scrub oak.

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
1	Deciduous trees; 50–100% crown cover density; the dominant species are the California oak; other species include California sycamore, Fremont cottonwood, or an occasional Digger pine; the larger oaks are 18–24 m (60–80 ft) in height and 30–183 cm (12–72 in) in diameter; trees closely spaced 1–4 m (3–12 ft) apart; undergrowth dense, consisting of brush and scrub trees; 75% or more of each stand composed of deciduous species.	Covers a very small portion of Hunter Liggett and can usually be found in the more remote deeper canyons and along the streams.	The better timber producing trees occur within these areas.	Cover for foot troops from flat-trajectory fire of small arms is fair depending on trunk diameters.	Concealment from aerial & ground observation is good for foot troops and vehicles when trees are in leaf, and fair during the leafless period.
2	Deciduous trees; 10–50% crown cover density; dominant species include California live oak, commonly 8 m (26 ft) in height, multistemmed, blue oak that averages 15–23 m (50–75 ft) in height and 30–91 cm (12–36 in) in diameter, and the California or valley white oak attaining heights of 27–38 m (90–125 ft) with diameters of 91–183 cm (36–72 in); Digger pine, a coniferous tree, attains heights of 12–18 m (40–60 ft) and diameters of 30–61 cm (12–24 in) occurring scattered throughout the area; undergrowth is fairly open and consists chiefly of grasses and forbs; trees generally widely spaced; 75% or more of each stand composed of deciduous species.	Covers approximately 20% of the fort area and is located primarily in the central and on the northeastern side; occurs in areas of lower relief that are starting up the slope.	Since many of these areas are close to the fort's military activities, controlled burning is used to reduce fire danger; some of the areas are used for the grazing of cattle and sheep.	Cover for foot troops from flat-trajectory fire of small arms is fair.	Concealment from aerial observation is largely fair for foot troops and poor for vehicles year round; concealment from ground observation is largely poor for both foot troops and vehicles.
3	Mixed deciduous and coniferous scrub; 50–100% canopy closure*; most areas extremely dense; shrub and plant species include chaparral, manzanita, chamise, buckbrush, choke cherry, toyon, California live oak, and scattered pines; heights up to 1.5 m (5 ft); roughly equal distribution of deciduous and coniferous species. *Canopy closure is used for scrub, since true crowns are lacking on this low growing scrub.	Along with Map Unit 4 this unit covers approximately 45–50% of Fort Hunter Liggett; most of the larger areas are primarily on the western and southern sides; smaller patches can be found scattered throughout especially on slopes and at higher elevations.	Fire can play a very important role in the distribution and density of both this unit and unit 4; brush is almost impenetrable for movement by foot troops and most vehicles.	Cover for foot troops and flat-trajectory fire of small arms is poor.	Concealment from aerial and ground observation is poor for both foot troops and vehicles; limited concealment for foot troops in prone position.
4	Mixed deciduous and coniferous scrub; 10–50% canopy closure (see Map Unit 3); spacing varies from sparse to dense; shrub and plant species include chaparral, manzanita, chamise, buckbrush, choke cherry, toyon, California live oak and scattered pines; low-growing open brush up to 1.5 m (5 ft) in height; roughly equal distribution of deciduous and coniferous species.	Along with Map Unit 3 this unit covers approximately 45–50% of Fort Hunter Liggett; most of this unit occurs primarily on the western and southern sides; however, smaller patches can be found scattered throughout especially on slopes and at higher elevations.	Fire can play a very important role in the distribution and density of both this unit and unit 3; the low-growing, open brush affords limited movement for foot troops and vehicles.	Cover for foot troops from flat-trajectory fire of small arms is poor.	Concealment from aerial and ground observation is poor for both foot troops and vehicles; limited concealment for foot troops in prone position.
5	Short grasses; less than 1 m (3 ft) in height; species include ryegrass, foxtail, and wild oats; includes some small bare areas usually in stream valleys and dry washes of larger stream beds; some scattered trees, not exceeding 10% crown cover density.	Covers approximately 20–25% of the fort; the majority of this unit is located in two major lowland areas called Stony Valley and the San Antonio River Valley.	Some of these areas are used for grazing of cattle and sheep; the vast majority of the fort's military activities occur in these grassland areas.	No cover for foot troops.	No concealment for both foot troops or vehicles.



HUNTER LIGGETT, CALIFORNIA TERRAIN ANALYSIS

VEGETATION

FORESTS

1. Deciduous trees; medium to dense spacing
2. Deciduous trees; nearly open to medium spacing

SCRUB

3. Mixed scrub; medium to dense spacing
4. Mixed scrub; nearly open to medium spacing

GRASSLANDS

5. Short grasses

OPEN

OPEN

6. Built-up areas; barren areas and heavily used areas. Vegetation not a significant factor.

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

H. CLIMATE

Fort Hunter Liggett is located approximately 96 km (60 mi) south of Fort Ord, California in the Santa Lucia Mountains, and 32 km (20 mi) from the Pacific Ocean. The post headquarters and cantonment area are located in the San Antonio River valley bounded on the west by the high ridges of the Santa Lucia Range, and on the east by the lower foothills. Elevations range from 1142 m (3744 ft) in the high western mountains to 488 m (1600 ft) in the eastern foothills. The valleys slope downward from approximately 427 m (1400 ft) in the northwest portion to 242 m (794 ft) in the southwest.

Fort Hunter Liggett has two distinct seasons. The dry season of little or no rain extends from May through October, and the wet season lasts from November through April. It should be noted that even though the winter season has the heaviest rainfall there are on the average only seven days each month with rain. Consequently, this means that in each "rainy" month most days are still rain-free. Additionally, annual rainfall is variable and one year may be very wet while the following year could be extremely dry.

Large diurnal temperature variations and the general existence of two low-level temperature inversions (temperature increasing with height) over the area are major features of the Hunter Liggett climatic picture. Diurnal ranges in excess of 28 C° (50 F°) are not uncommon in the valley areas, while the inversions can create lift problems for aircraft. Though located close to the cold Pacific Ocean, Hunter Liggett is barred from this modifying influence by high Santa Lucia Range. The summer months of July, August and September are the warmest with an average high of 33° C (92° F). The coolest months are December, January and February when the average minimum temperature is 0° C (32° F). The extreme recorded temperatures (which do not appear in the following climatological tables) are 46.1° C (115° F), occuring on 14 July 1972, and −11.1° C (12° F), occuring on 13 January 1963.

The following climatological table for Fort Hunter Liggett is based on a 7 to 8 year period of record, which is not wholly adequate for comparative purposes, but is indicative of the climate at this base. Although the climatological table does not indicate any significant snowfall, snow has been known to fall on the ranges in the north and western regions of the reservation.

CLIMATIC SUMMARY

PARAMETER DESCRIPTION		UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	YEARS OF RECORD
Temperature																
Absolute maximum temperature		(°C)	22.8	25.0	32.2	32.8	35.0	41.7	40.0	42.2	39.4	37.8	26.1	24.4	42.2	8
		(°F)	73	77	90	91	95	107	104	108	103	100	79	76	108	
Mean daily maximum temperature		(°C)	15.0	16.7	18.3	21.7	25.0	28.9	33.9	35.6	30.0	27.8	23.9	15.6	24.4	7
		(°F)	59	62	65	71	77	84	93	96	86	82	75	60	76	
Mean daily minimum temperature		(°C)	0.0	−0.6	1.7	3.3	5.0	7.8	9.4	10.6	6.7	5.0	4.4	0.0	4.4	7
		(°F)	32	31	35	38	41	46	49	51	44	41	40	32	40	
Absolute minimum temperature		(°C)	−6.1	−6.1	−5.0	−1.7	−1.7	0.6	2.2	3.9	1.7	−2.2	−5.0	−5.6	−6.1	8
		(°F)	21	21	23	29	29	33	36	39	35	28	23	22	21	
Mean no. days with maximum temperature ≧90° F (32.2° C)		days	0	0	0	#	5	12	23	22	16	5	#	0	83	7
Mean no. days with minimum temperature ≦32° F (0.0° C)		days	17	11	7	2	#	0	0	0	#	3	12	16	68	7
Mean dew point temperature		(°C)	2.8	3.3	3.9	6.7	6.1	7.2	9.4	9.4	8.9	5.0	4.4	3.3	6.1	7
		(°F)	37	38	39	44	43	45	49	49	48	41	40	38	43	
Precipitation and Humidity																
Mean percent relative humidity		%	79	73	70	68	60	57	51	55	55	56	67	79	64	7
Mean percent relative humidity at 0400 LST		%	95	94	97	95	90	81	72	68	80	80	96	98	87	7
Mean percent relative humidity at 1300 LST		%	56	56	50	42	33	29	26	25	25	30	50	54	39	7
Mean no. days with precipitation ≧0.01 in. (0.25 mm)		days	4.6	4.6	4.6	3.2	0.9	0.3	0.4	0.3	1.0	1.4	2.6	4.8	28.7	7
Mean no. days with precipitation ≧0.5 in. (12.7 mm)		days	2	2	1	1	#	0	0	0	#	#	1	2	9	9
Mean monthly precipitation		mm	170.2	76.2	55.9	40.6	1.0	0.5	0.5	0.3	5.1	10.2	104.1	68.6	533.2	7
		in	6.7	3.0	2.2	1.6	0.04	0.02	0.02	0.01	0.2	0.4	4.1	2.7	21.0	
Absolute maximum 24-hours precipitation		mm	83.8	91.4	35.6	27.9	2.5	1.3	2.5	1.0	7.6	33.0	78.7	78.7	91.4	8
		in	3.3	3.6	1.4	1.1	0.1	0.05	0.1	0.04	0.3	1.3	3.1	3.1	3.6	
Mean no. days with thunderstorms		days	0.1	0.1	0.1	0.1	0.4	0.3	0.0	0.1	0.2	0.1	0.0	0.2	1.7	7
Snowfall			No recorded snowfall in 7 years of record													
Wind and Pressure																
Prevailing direction of wind		direction	NNW	NNW	NNW	NNW	NNW	NW	NW	NW	NW	NNW	NNW	NNW	NNW	7
Mean wind speed		kmph	6	6	6	7	7	7	7	7	6	6	6	6	6	7
		knots	3	3	3	4	4	4	4	4	3	3	3	3	3	
Extreme wind speed (peak gust)		kmph	39	30	39	30	30	30	30	30	20	20	20	30	39	8
		knots	21	16	21	16	16	16	16	16	11	11	11	16	21	
Vapor pressure		cm Hg	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		in Hg	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pressure altitude (99.95%)		m	259	287	281	288	296	314	308	314	311	284	274	271	290	7
		ft	850	940	920	950	970	1030	1010	1030	1020	930	900	890	950	
Percent frequency of surface wind speed ≧28 knots (32.2 mph or 51.9 kmph)		%	0	0	0.1	0.1	0.2	0.4	0.2	0.1	0	0	0	0	0.1	7
Percent frequency of surface wind speed ≧17 knots (19.6 mph or 31.5 kmph)		%	2.3	2.9	4.6	6.5	10.3	13.7	11.8	8.8	5.0	2.6	2.0	2.0	6.0	7
Mean no. days with surface wind ≧17 knots (19.6 mph or 31.5 kmph) and no precipitation		days	1.4	2.7	4.1	7.4	12.4	16.3	15.5	14.5	7.7	3.9	0.8	0.7	87.4	7
Mean no. days with surface wind 4 – 10 knots (4.6 – 11.5 mph or 7.4 – 18.5 kmph) and temperature 33 – 89°F (0.6 – 31.7°C) and no precipitation		days	13.8	11.5	14.0	17.0	17.0	15.9	18.2	16.0	12.0	12.5	17.7	16.0	181.6	7
Visibility																
Mean cloudiness		tenths	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mean no. days with fog (visibility less than 7 mi or 11 km)		days	8	3	4	3	1	1	0	2	2	3	5	6	38	7
Mean no. days with an occurrence of visibility less than 0.5 mi (0.8 km)		days	7	5.6	3.9	3.2	1.5	0.3	0.5	0.7	1.7	3.7	5.7	7.3	41.1	7
Percent frequency ceiling ≦5000 ft (1524 m) or visibility ≦5 mi (8 km)		%	31.9	21.8	23.1	21.5	14.9	13.4	4.5	7.3	9.9	8.7	18.9	27.5	17.0	7
Percent frequency ceiling ≦1500 ft (457 m) or visibility ≦3 mi (4.8 km)	for 0000–0200 LST	%	17.4	9.7	8.8	15.2	10.0	12.1	4.3	6.3	7.0	8.6	10.5	15.3	10.4	7
	for 0300–0500 LST	%	25.4	19.5	17.6	26.7	22.3	25.8	14.3	19.5	22.4	18.6	20.0	27.2	21.6	7
	for 0600–0800 LST	%	33.4	20.0	24.0	28.7	19.9	20.3	12.7	20.3	26.9	20.8	27.5	30.9	24.6	7
	for 0900–1100 LST	%	26.5	13.9	11.0	8.7	3.4	1.3	0.7	0.7	1.3	3.9	12.7	20.8	8.7	7
	for 1200–1400 LST	%	9.3	2.4	2.8	2.6	0.2	0.4	0.0	0.0	0.0	1.1	3.5	7.6	2.5	7
	for 1500–1700 LST	%	4.0	2.4	1.8	1.1	1.4	1.0	0.0	0.0	0.0	1.1	2.7	7.4	2.0	7
	for 1800–2000 LST	%	3.6	2.6	1.4	1.7	2.5	1.2	0.0	0.5	0.0	0.7	2.7	4.9	1.8	7
	for 2100–2300 LST	%	7.7	3.9	1.8	4.1	3.2	2.9	0.7	1.4	0.2	1.6	4.4	7.1	3.3	7
Percent frequency ceiling ≦300 ft (914 m) or visibility ≦1 mi (1.6 km)	for 0000–0200 LST	%	4.1	3.6	1.2	2.4	0.5	0.2	0.2	0.0	0.4	4.1	4.3	5.2	2.2	7
	for 0300–0500 LST	%	12.2	9.5	7.4	7.8	4.3	1.5	1.4	2.2	3.3	10.4	9.7	14.8	7.0	7
	for 0600–0800 LST	%	18.1	18.3	11.0	7.6	2.9	0.0	0.5	2.0	5.6	11.5	14.8	18.5	9.3	7
	for 0900–1100 LST	%	10.9	5.7	1.4	0.2	0.0	0.0	0.0	0.0	0.0	0.7	4.0	9.7	2.7	7
	for 1200–1400 LST	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	7
	for 1500–1700 LST	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	7
	for 1800–2000 LST	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
	for 2100–2300 LST	%	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.8	0.9	0.2	7
Mean no. days with sky cover ≦30% and visibility ≧3 mi (4.8 km)	at 1600 LST	days	10.0	12.6	12.6	15.0	19.7	24.5	26.7	27.8	24.8	24.8	17.1	11.6	227.2	7
	at 2200 LST	days	15.0	17.4	20.0	20.5	24.0	25.3	28.8	28.6	27.5	27.2	21.1	17.5	272.9	7
	at 0400 LST	days	12.3	15.1	15.0	13.0	17.1	16.6	22.2	21.6	19.3	21.3	17.1	13.6	204.2	7
	at 1000 LST	days	8.2	12.6	10.8	14.0	19.2	22.4	26.3	27.0	25.3	23.8	14.9	10.3	214.8	7
Mean no. days with ceiling ≧1000 ft (305 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	30.7	27.7	30.8	30.0	30.7	30.0	31.0	31.0	30.0	31.0	29.7	30.0	362.6	7
	at 2200 LST	days	29.5	27.8	31.0	29.5	30.5	29.6	31.0	30.5	30.0	31.0	29.3	30.1	360.2	7
	at 0400 LST	days	24.5	23.5	26.5	23.6	25.3	24.1	26.7	26.3	24.0	26.2	24.8	23.8	299.3	7
	at 1000 LST	days	24.3	25.3	29.3	29.2	30.7	30.0	31.0	31.0	30.0	30.3	27.3	25.5	343.9	7
Mean no. days with ceiling ≧2000 ft (610 m) and visibility ≧3 mi (4.8 km) and surface wind ≦10 knots (11.5 mph or 18.5 kmph)	at 1600 LST	days	28.0	12.4	11.3	7.5	4.8	2.9	1.8	2.7	5.8	10.7	17.3	21.4	116.6	7
	at 2200 LST	days	24.6	24.8	24.5	21.5	18.0	15.5	24.8	22.8	22.8	26.2	27.6	26.8	280.1	7
	at 0400 LST	days	21.0	21.2	23.2	19.5	22.3	18.9	26.2	24.8	22.5	24.3	22.1	21.7	267.7	7
	at 1000 LST	days	18.5	20.4	21.0	21.0	20.6	20.8	23.0	25.5	26.6	26.7	22.6	19.2	265.9	7
Mean no. days with ceiling ≧2500 ft (762 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	27.5	26.3	29.1	29.0	30.5	29.5	31.0	31.0	30.0	30.7	28.4	28.4	351.4	7
	at 2200 LST	days	26.7	25.8	29.3	28.5	29.5	29.0	31.0	30.5	29.6	30.7	28.3	27.7	356.6	7
	at 0400 LST	days	21.6	21.4	23.9	20.3	22.5	20.3	26.0	24.6	22.0	24.8	22.4	21.7	271.5	7
	at 1000 LST	days	19.8	22.0	26.7	25.7	29.5	28.8	20.7	30.7	29.8	29.6	24.6	21.5	320.4	7
Mean no. days with ceiling ≧6000 ft (1829 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	25.1	23.4	26.5	26.5	29.1	29.1	31.0	30.8	29.3	30.3	27.0	26.4	334.5	7
	at 2200 LST	days	22.8	23.9	26.9	26.8	28.6	28.3	30.8	30.5	29.3	30.5	26.4	25.5	330.3	7
	at 0400 LST	days	18.2	19.7	20.2	18.8	21.3	19.7	26.0	24.6	21.8	24.8	21.0	18.9	255.0	7
	at 1000 LST	days	17.1	21.5	22.4	23.6	27.0	27.4	30.7	30.3	29.3	29.1	23.6	19.2	301.2	7
Mean no. days with ceiling ≧10,000 ft (3048 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	24.3	22.8	25.2	25.3	28.8	28.8	30.7	30.8	29.2	29.8	26.4	25.2	327.3	7
	at 2200 LST	days	22.5	23.0	26.0	26.6	28.6	28.1	30.7	30.5	29.3	30.3	26.0	24.5	326.1	7
	at 0400 LST	days	17.6	19.2	19.8	18.3	21.1	19.4	26.0	24.3	21.7	24.5	20.9	18.2	251.0	7
	at 1000 LST	days	16.6	20.9	21.9	23.0	26.7	26.9	30.5	30.2	29.2	28.8	23.4	18.4	296.5	7

LST = Local Standard Time

— = No data

= Less than 0.5 day

EPHEMERIS FOR CAMP ROBERTS, CALIFORNIA
(Pacific Standard Time)

DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET
January 1	0615	1802	0716	1702	July 1	0344	2033	0452	1926
January 11	0616	1810	0716	1710	July 11	0350	2030	0457	1923
January 21	0614	1819	0713	1720	July 21	0359	2023	0504	1918
February 1	0608	1829	0706	1732	August 1	0409	2012	0512	1910
February 11	0600	1829	0657	1742	August 11	0419	2000	0520	1900
February 21	0550	1848	0646	1752	August 21	0429	1946	0528	1848
March 1	0540	1855	0635	1800	September 1	0439	1930	0536	1833
March 11	0527	1904	0622	1809	September 11	0448	1915	0544	1818
March 21	0512	1913	0608	1817	September 21	0456	1859	0552	1804
April 1	0456	1923	0552	1827	October 1	0504	1844	0600	1749
April 11	0440	1932	0538	1835	October 11	0513	1830	0608	1735
April 21	0426	1942	0524	1843	October 21	0521	1818	0617	1722
May 1	0412	1953	0513	1852	November 1	0530	1806	0627	1709
May 11	0400	2003	0503	1900	November 11	0539	1758	0637	1700
May 21	0351	2013	0455	1908	November 21	0548	1753	0647	1654
June 1	0343	2022	0450	1916	December 1	0557	1751	0657	1651
June 11	0340	2029	0448	1922	December 11	0605	1752	0705	1651
June 21	0340	2033	0448	1925	December 21	0611	1755	0712	1654

I. CROSS-COUNTRY MOVEMENT

Cross-country movement (CCM) conditions, or off-road movement, at Fort Hunter Liggett, are shown on the accompanying map. Additional details are provided in the following text and table. CCM conditions have been derived mainly from vegetation, soils, and surface configuration data prepared for and appearing separately in this terrain analysis. Supplemental sources included 1:30,000 scale aerial photography, topographic maps, field notes and photography, and miscellaneous textual material.

The map and predicted movement evaluations should be used only as guides in planning military training activities. For exact movement routes, reconnaissance on the ground is recommended. Data on the terrain factors and the evaluations are generalized to suit the scale of the map. Many areas of minor areal extent such as small tracts of forest, cleared areas, short sharp slopes, and depressions, are too small to portray.

The predicted movement ratings are those believed to prevail during most of the year. Variations in these evaluations may occur from year to year, and even within a season, due to abnormal variations in the weather. Normally, movement will be degraded two or three days per month during the period from about October through April, the time of the winter rains. During periods of dry weather, severe dust problems may occur in areas with little or no vegetation, causing limited visibility.

The evaluations are based on terrain conditions as they are known at present. Future alterations of the terrain, such as timber clearing operations, dam and reservoir building, and road construction, would obviously change cross-country movement conditions.

Built-up areas, such as urban and cantonment areas, are not evaluated on this map.

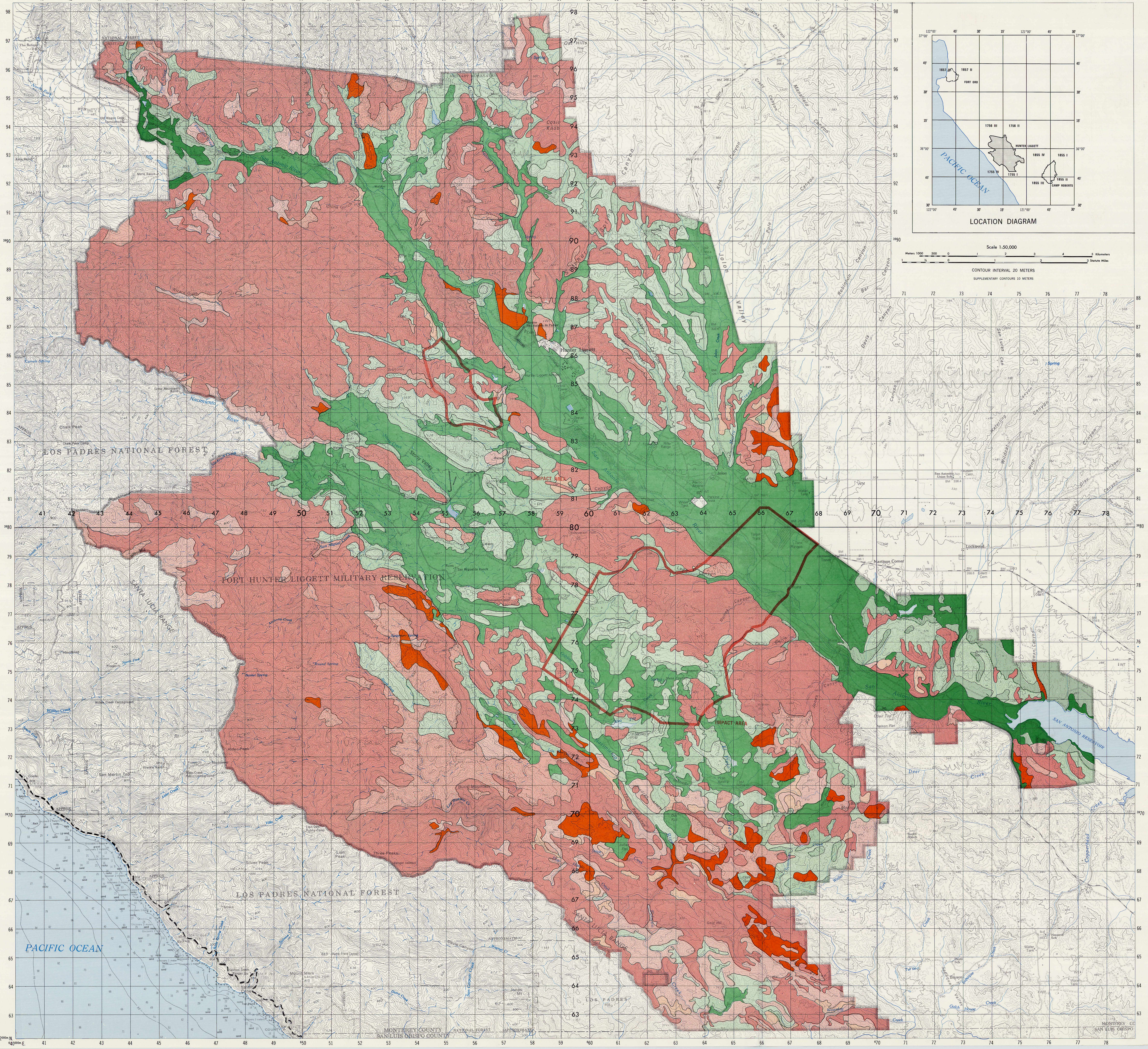
Movement in the indicated impact areas may be restricted during periods of live fire. Caution should be taken when moving through these areas because of the existence of unexploded ammunition.

GENERAL TERRAIN AND MOVEMENT DESCRIPTION

MAP UNIT	GENERALIZED TERRAIN CONDITIONS	MOVEMENT OF TRACKED VEHICLES 1/	MOVEMENT OF WHEELED VEHICLES 2/	MOVEMENT OF FOOT TROOPS
1	Gently sloping grass-covered valleys including significant areas of bare ground usually associated with stream valleys and dry washes of the larger streambeds. Most slopes are less than 5 percent with some ranging as high as 8 percent. Soils predominantly deep shaly loams with some sandy loam along the steeper slopes. Some clay loam concentrations along stream channels. Grasses generally less than 1m (3 ft) tall. Trees widely scattered throughout area.	Generally easy in any direction for both tank and APC. Local obstructions can easily be bypassed. Grass-cover reduces dust problems during dry weather. Narrow valleys restrict movement and should be avoided when there is a possibility of flash flooding.	Fairly easy most of the year in any direction for both truck and jeep. Slipperiness will slow movement in clayey areas when wet. Narrow valleys restrict maneuverability and drainage channels will slow movement speeds. Narrow valleys should be avoided during possible flash flooding periods.	Unhindered in most instances. Movement hindered slightly during and after periods of rainy weather due to stickiness and slipperiness of soils in some areas.
2	Moderately sloping grassland with widely scattered trees. Areas generally located between valley and upland regions. Slopes generally 8 to 30 percent. Soils are sandy or loamy. Vegetation is primarily short grass less than 1 m (3 ft) high. Widely scattered trees or clumps of trees cover about 20 percent of the area.	Generally unrestricted through out the year. Scattered trees and other local obstacles easily bypassed. Wet soils may restrict movement during long rainy periods. Soft soil conditions last somewhat longer on loamy soils than sandy soils, but low strength soil conditions seldom exceed more than 2 days.	Somewhat hindered by moderate slopes. Upslope movement is severely restricted when grasses wet. Wet soils conditions will also affect traction of vehicles causing less maneuverability.	Unhindered in most instances except during prolonged rainy periods.
3	Moderately to highly dissected grass-covered uplands with interspersed woodlands generally located on hillsides. Slopes mostly range between 30 and 45 percent. Soils mainly mixed sandy loam containing varying amounts of gravel, cobbles, and stones.	Moderately slowed by steepness of slopes. Local areas of dense trees require bypassing. Soils offer firm support when either dry or wet. Wet grassy slopes additional hindrance to maneuverability.	Moderately to severely restricted by steepness of slopes. Slipperiness of grass during wet periods precludes movement on steeper slopes. Stony areas restrict jeep movement more than truck.	Movement slowed by moderate slopes. Wet grasses and stony areas will further slow rate of movements.
4	Gently rolling hills in the central portion of the Fort and some areas along stream channels. Slopes range between 3 and 30 percent. Soils are generally clay loam, sandy loam, and gravel. Vegetation consists of low-growing brush and scrub intermixed with patches of trees randomly spaced. Trees generally spaced 1 to 4 m (3–13 ft) apart.	Moderately restricted by patches of trees and low scrub growth; patches of trees generally require bypassing.	Moderately restricted by patches of trees and scrub growth; patches of trees generally require bypassing.	Moderately restricted by large clumps of scrub vegetation. During and after precipitation, slipperiness or stickiness of soil will further hinder movement.
5	Moderate to dense brush- and scrub-covered upland areas generally located between valleys and steeply sloping areas. Slopes are moderate, varying between 8 and 30 percent. Soils are mainly sandy loam gravel, and some shaly clay. Areas of deciduous trees intermixed with brush- and scrub-growth dot this map unit.	Moderately restricted by areas of medium to dense vegetation. During wet periods, slipperiness of the steeper slopes in combination with wet vegetation will further hinder movement.	Movement generally unsuited due to areas of medium to dense vegetation.	Moderately hindered by medium to dense vegetation.
6	Scattered areas of dense brush and scrub located along base of the gently rolling hills in the southern portion of the Fort. Slopes mainly gentle to moderate (0 to 30 percent). Soils mainly sandy loams or shaly clays. The extremely dense brush is up to 1.5 m (5 ft) tall.	Moderately to severely slowed by dense brush and scrub. Tank movement is somewhat easier than that of the APC.	Movement generally unsuited for wheeled vehicular movement due to dense vegetation and moderate slopes.	Practically impenetrable to movement due to extremely dense brush and scrub.
7	Moderate to steep hills covered with dense brush and scrub. Slopes generally between 30 and 45 percent. Clay and sandy soils firm, except clays commonly slippery when wet. Medium to dense brush and scrub growth predominates in this area. Some exposed bedrock.	Tank and APC movement not practical due to medium to dense vegetation in combination with moderate to steep slopes.	Generally unsuited. Steepness of slopes restricts truck and jeep movement to a minimum.	Movement is severely restricted due to dense vegetation. Additionally slowed when clayey soils wet and slippery.
8	Predominantly hilly terrain covered with dense brush and thickets with numerous scattered rock outcrops. Slopes are generally steep, ranging between 45 and 100 percent. Soils are generally shallow sands, clays, and gravels over weathered bedrock. Vegetation is primarily scrub up to 1.5 m (5 ft) in height along the hillsides and scattered patches of scrub trees in the stream valleys.	Terrain is unsuited for off-road movement. Thick brush, steep slopes, and jagged rock outcrops preclude movement of the tank and APC.	Precluded at all times due to dense vegetation and steep slopes.	Movement severely slowed during both wet and dry periods due to steep, scrub-covered slopes.
9	Built-up areas with medium to high density of construction, such as urban and cantonment areas.	Not evaluated	Not evaluated	Not evaluated

1/ Comments apply to the M-60 tank and the M-113 armored personnel carrier (APC).

2/ Comments apply to the M-35, 2½ ton truck and the M-151, ¼ ton truck.



HUNTER LIGGETT, CALIFORNIA TERRAIN ANALYSIS

CROSS-COUNTRY MOVEMENT

MAP UNIT	TERRAIN UNIT	PREDICTED MOVEMENT RATINGS FOR:				
		TANK (M-60)	APC (M-113)	2½t TRUCK (M-35)	¼t JEEP (M-151)	FOOT TROOPS
1	Gently sloping grassland and bare ground.	Good	Good	Good	Good	Good
2	Moderately sloping grasslands with widely scattered trees.	Good	Good	Fair	Fair	Good
3	Moderately to highly dissected grasscovered uplands with interspersed woodlands.	Fair	Fair	Poor	Poor	Fair
4	Moderate to dense brush and scrub areas located on gentle slopes.	Fair	Fair	Fair	Fair	Fair
5	Moderate to dense brush and scrub-covered upland areas with scattered trees.	Fair	Fair	Unsuited	Unsuited	Fair
6	Dense brush and scrub on gently rolling hills.	Fair	Poor	Unsuited	Unsuited	Poor
7	Moderate to steep hills covered with dense brush and scrub. Some rock outcrop.	Poor	Poor	Unsuited	Unsuited	Poor
8	Steep, rugged, brush and scrub covered hills.	Unsuited	Unsuited	Unsuited	Unsuited	Poor
OPEN 9	Built-up areas	Urban and built-up areas not evaluated				

Impact area boundary

EXPLANATION OF RATING TERMS

Good ...... Conditions permit free movement in any direction. Terrain will permit 12 or more vehicle passes in trace or permit at least one maneuver (starts, stops, sharp turns, or crossing of tracks) at one location.

Fair .... Conditions moderately hinder progress or moderately restrict choices of direction for movement. Terrain will permit 3 to 12 passes in trace but maneuvering will be difficult.

Poor .... Conditions severely hinder progress or greatly restrict choice of movement routes. Terrain will probably permit up to 3 passes in trace. Very cautious driving required. Movement in trace should be avoided when possible.

Unsuited ... Conditions preclude all but local movement. Engineering work required for vehicular movement.

NOTE: Impact areas may be restricted during periods of live fire. Caution should be taken when moving through these areas because of the existence of unexploded munitions.

NOTE: Number refers to entry in table.

NOTE

Cross-country movement is defined as the off-road movement of military vehicles and personnel. The principal areal features that contribute to the cross-country movement rating of a terrain unit are soil type, state of ground (wet, dry, frozen), slope, vegetation, surface shape (rough, smooth, furrowed), and lakes and reservoirs. The principal linear features that affect cross-country movement are railroad and highway cuts and fills and rivers and streams. Natural and man-made features such as boulders, escarpments, and structures of all kinds also affect cross-country movement. The movement of different vehicles on the same terrain may be radically different, ranging from unable to travel for one vehicle to able to travel easily for another vehicle. The same terrain may afford different cross-country movement to the same vehicle at different times, depending, for example, on the time elapsed since the last rainfall. Driver skill and mechanical condition of the vehicle also can affect cross-country movement.

This map is primarily intended as a tool for the formulation of military stationing plans such as the relocation of a large unit or the selection of training areas. It is not intended to be the sole source for the selection of specific off-road routes for vehicles or personnel, but is a good base from which to plan additional study and ground reconnaissance for that purpose.

The data on terrain factors examined and the cross-country movement evaluations resulting were necessarily generalized to suit the scale and purpose of the map. Thus an area marked with a specific rating may contain areas, too small to be mapped, that have better or worse ratings. However, the significant occurrence of such cases is noted in the description of generalized terrain conditions.

The cross-country movement ratings were assigned on the basis of normal weather in the specified period, i.e., the ratings apply to most of the days in that period. Variations in the ratings for relatively short periods may occur from year to year or even within the same specified period because of unusual weather such as prolonged periods of drought or heavy precipitation.

The cantonment area has been excluded from this analysis. Impact and demolition (demo) areas are included. However, these areas are normally off-limits for training purposes since unexploded munitions pose a danger to troops and vehicles.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

J. LINES OF COMMUNICATION

Lines of Communication (LOC) at Fort Hunter Liggett are depicted on the accompanying map. Supportive information for LOC as shown on the graphic is provided in the tables following this summary.

ROADS: The road network of Fort Hunter Liggett consists of hard surface, loose surface, improved and unimproved dirt roads and tank trails. Most loose surface roads can serve as tank trails. In effect, there are several hundred miles of tank trails, many of which have been omitted. Some of the minor hard surface and dirt roads have also been omitted from the graphic, while the ones selected depict prevailing patterns and system connections. The length of the road system on the map is approximately 932 kilometers (579 miles), of which 109 kilometers (68 miles) are hard surface. Data on military load classification and road shoulder characteristics are not available. Refer to Roads, Fort Hunter-Liggett, for individual road details.

ROAD BRIDGES: There are relatively few road bridges within the reservation boundary; most of which are rather small and in fair to good condition. The table Road Bridges, Fort Hunter-Liggett, provides available details pertaining to each bridge.

RAILROADS: There are no railroads within the Fort Hunter-Liggett Military Reservation; the nearest railhead is located at King City, approximately 30 kilometers (19 miles) north-northeast of the main cantonment area.

AIRFIELDS/AIRSTRIPS: One airfield and seven airstrips are located within the reservation boundary. Hunter Liggett Army Airfield is located approximately one mile south of the Headquarters area and is now permanently closed to fixed wing aircraft. New construction close to the runway makes its use too dangerous. Six of the seven small airstrips once used for fixed wing aircraft are now used almost exclusively as Helicopter Landing Zones (HLZ), and one is closed permanently. The U.S. Forest Service occasionally uses light fixed wing aircraft on one of the airstrips. Refer to Airfields/Airstrips, Fort Hunter Liggett for details.

HELICOPTER LANDING ZONES (HLZ): The HLZ adjacent to the Hunter-Liggett Army Airfield is utilized by rotary wing aircraft in support of the Combat Developments Experimentation Command (CDEC). The other HLZs are six of the former airstrips. See Helicopter Landing Zones, Fort Hunter-Liggett, for additional details.

1. ROADS

ROUTE NAME	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ CONDITION	REMARKS
Adice Road	637748	664772	4 km (2.5 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring. Also used as a tank trail.
Argyle Road	649821	665865	4.7 km (2.9 mi)	No data	Fair-weather	Gravel	3 m (10 ft); Poor	No data	No data	
Bald Mountain Road	684718	694703	3 km (1.9 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Bear Trap Road	652709	672729	8.8 km (5.5 mi)	No data	All-weather	Medium Bituminous	6.1 m (20 ft); Good	No data	No data	
					Fair-weather	Gravel	5 m (16 ft); Fair	No data	No data	
Segment 1	652709	666701	4 km (2.5 mi)	No data	Fair-weather	Gravel	5 m (16 ft); Fair	No data	No data	
Segment 2	666701	672729	4.8 km (3 mi)	No data	All-weather	Medium Bituminous	6.1 m (20 ft); Good	No data	No data	
Bradley Road	644819	693784	6 km (3.7 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
Burma Road	479754	555756	10 km (6.2 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Coyote Mesa Road	609749	655718	7.1 km (4.4 mi)	No data	Fair-weather	Dirt	No data	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Del Venturi Road	510928	574852	11.2 km (7 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Fair	No data	No data	
Forest Creek Road	518944	519926	2 km (1.2 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
G Tank Road	535898	582863	7 km (4.4 mi)	No data	Fair-weather	Gravel	3 m (10 ft); Poor	No data	No data	Also used as a tank trail.
Gabilon Road	585778	613713	8 km (5 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Good	No data	No data	
Haycamp Road	573805	591825	2.8 km (1.7 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Good	No data	No data	
Infantry Road	586863	602836	3.7 km (2.3 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Fair	No data	No data	
Interlake Road	731777	750709	8.3 km (5.2 mi)	No data	All-weather	Medium Bituminous	7.3 m (24 ft); Good	No data	No data	
Jolon Road	644819	638908	9.1 km (5.7 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
KD Range Road	601849	635818	5 km (3.1 mi)	No data	Fair-weather	Gravel	5.5 m (18 ft); Fair	No data	No data	3.5 km (2.2 mi) segment from 601849 to 631831 is also used as a tank trail.
Little Salmon Road	622671	642625	5.7 km (3.5 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Fair	No data	No data	
Los Bueyos Road	551782	604732	11 km (6.8 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Fair	No data	No data	
Los Burros Road	513692	566732	9 km (5.6 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Lugo Road	594768	651785	7.8 km (4.9 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring. Also used as a tank trail.
McKern Road	468812	519799	6.5 km (4 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Mission Road	583864	644819	9.2 km (5.7 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Excellent	No data	No data	
Mission Creek Road	563940	582863	8.5 km (5.3 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data	
					Fair-weather	Gravel	6.1 m (20 ft); Fair			
Segment 1	563940	580874	7.3 km (4.5 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Fair	No data	No data	
Segment 2	580874	582863	1.2 km (.8 mi)	No data	All-weather	Asphaltic Concrete	7.3 m (24 ft); Good	No data	No data	
Nacimiento Road	491829	585859	15.6 km (9.7 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data	
Nacimiento-Fergusson Road	589835	601836	1.4 km (.9 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data	
Oak Flat Road	625711	694705	12.5 km (7.8 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Ord Fino Road	574806	608815	3.3 km (2.1 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring. Also used as a tank trail.
Palisades Road	613713	622671	5.4 km (3.4 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Fair	No data	No data	
Sam Jones Road	651710	693785	10.4 km (6.5 mi)	No data	All-Weather	Medium Bituminous	6.1 m (20 ft); Fair	No data	No data	
San Antonio River Road	592830	686754	12.5 km (7.8 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Fair	No data	No data	Also used as a tank trail.
San Corpoforo Road	613713	651710	4.4 km (2.7 mi)	No data	All-weather	Medium Bituminous	6.1 m (20 ft); Fair	No data	No data	
San Miguelito Loop Road	544808	561819	12.5 km (7.8 mi)	No data	All-weather	Medium Bituminous	6.1 m (20 ft); Fair	No data	No data	
Service Road	490831	538889	15.7 km (9.8 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Site Alpha Road	556915	574908	3.5 km (2.2 mi)	No data	Fair-weather	Gravel	5 m (16 ft); Fair	No data	No data	
Site 8 Road	581796	594797	2.7 km (1.7 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Good	No data	No data	
Stony Creek Road	511870	517848	2.6 km (1.6 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Sulphur Spring Road	585859	638899	8.7 km (5.4 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Good	No data	No data	
Tank Road	604847	609829	2.5 km (1.6 mi)	No data	Fair-weather	Gravel	3.7 m (12 ft); Poor	No data	No data	
Upper Milpitas Road	442942	606899	21.1 km (13.1 mi)	No data	All-weather	Medium Bituminous	6.1 m (20 ft); Good	No data	No data	
					Fair-weather	Gravel				
Segment 1	442942	510928	7.3 km (4.5 mi)	No data	All-weather	Medium Bituminous	6.1 m (20 ft); Good	No data	No data	
Segment 2	510928	606899	13.8 km (8.6 mi)	No data	Fair-weather	Gravel	6.1 m (20 ft); Good	No data	No data	
Vasquez Boulevard	572830	574852	2.9 km (1.8 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Fair	No data	No data	
Venturi Road	574852	585859	1.3 km (.8 mi)	No data	All-weather	Asphaltic Concrete	6.1 m (20 ft); Fair	No data	No data	
Venturi Canyon Road	511870	552861	4.5 km (2.8 mi)	No data	Fair-weather	Dirt	3 m (10 ft); Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.

1. ROADS (Continued)

ROUTE NAME	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ CONDITION	REMARKS
Additional Installation Routes (Unnamed)										
Improved Dirt Roads			179 km (111 mi)	No data	Fair-weather	Dirt	3 – 7.3 m (10 – 24 ft); Fair to Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Unimproved Dirt Roads			644 km (400 mi)	No data	Fair-weather	Dirt	3 – 7.3 m (10 – 24 ft); Fair to Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Tank trails	Unnamed		48.8 km (30.5 mi)	No data	Fair-weather	Dirt and/or Gravel	3 – 7.3 m (10 – 24 ft); Fair to Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring. On occasion any loose surface may be used as a tank trail.
	Tank road between Fort Hunter-Liggett and Camp Roberts		35.2 km (22 mi)	No data	Fair-weather	Gravel	6.1 – 7.3 m (20 – 24 ft); No data	No data	No data	

ROAD BRIDGES

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION	DIMENSIONS LENGTH/OVERALL WIDTH/ ROADWAY WIDTH	CLEARANCE	TYPE/CONSTRUCTION MATERIAL	CONDITION
1	Nacimiento Road	588835	San Antonio River	6T 12W 2 lane	88 m (287 ft) long; overall width – No data; roadway width 5.1 m (16 ft 8 in).	Limited vertical; 4 m (13 ft); horizontal – No data.	Two span steel through truss, with 2 span timber stringer approach; wooden deck.	Fair
2	Nacimiento Road	4552809	Stony Creek	22T 24W 2 lane	18 m (60 ft) long; overall width – No data; roadway width 7 m (23 ft).	Unlimited vertical; horizontal – No data.	Deck; reinforced concrete.	Fair
3	San Miguelito Loop Road	549785	Stony Creek	10T 7W 2 lane	9.5 m (31 ft) long; overall width – No data; roadway width 7.5 m (24 ft 6 in).	Unlimited vertical; horizontal – No data.	Deck; 3 span timber stringer.	Fair
4	Bradley Road	649815	Jolon Creek	No data 2 lane	24 m (78 ft) long; overall width – No data; roadway width 9 m (30 ft).	Unlimited vertical; horizontal – No data.	Stringer construction; reinforced concrete.	Good
5	Sam Jones Road	687756	San Antonio River	60T 50W 1 lane	92 m (302 ft) long; overall width – No data; roadway width 3.9 m (12 ft 8 in).	Unlimited vertical; horizontal – No data.	5 span steel girder, with wooden deck.	Good
6	No data	649820	Jolon Creek	30T 19W 1 lane	19 m (62 ft) long; overall width – No data; roadway width 4 m (13 ft).	Unlimited vertical; horizontal – No data.	4 span timber stringer, with wooden deck.	Fair
7	Interlake Road	726741	San Antonio River	No data 2 lanes	89 m (292 ft) long; overall width – No data; roadway width 10.7 m (35 ft).	Unlimited vertical; horizontal – No data.	Type – No data; reinforced concrete.	Good
8	San Corpoforo Road	651709	El Piojo Creek	35T 50W 2 lanes	4.6 m (15 ft) long; overall width – No data; roadway width 7.1 m (23 ft 3 in).	Unlimited vertical; horizontal – No data.	Single span stringer, PMS surfacing.	Good
9	No data	575865	Mission Creek	No data 1 lane	22.9 m (75 ft) long; overall width – No data; roadway width 5 m (16 ft 4 in)	Unlimited vertical; horizontal – No data.	No data	Fair
10	Venturi Road	579855	San Antonio River	No data 2 lanes	27.7 m (81 ft) long; overall width – No data; roadway width 9.4 m (31 ft).	Unlimited vertical; horizontal – No data.	No data	Fair
11	Upper Milpitas Road	528922	Bear Creek	6T 9W 2 lane	8.5 m (28 ft) long; overall width – No data; roadway width 6.7 m (22 ft).	No data	Single span timber stringer and steel beam bridge over creek.	Fair
12	Upper Milpitas Road	520925	Forest Creek	50W 1 lane	1.8 m (6 ft) long; overall width – No data; roadway width 4.3 m (14 ft).	No data	Reinforced concrete box culvert.	Good
13	Unnamed road	578946	Foot of Pine Canyon grade	25T 30W 1 lane	8.5 m (28 ft) long; overall width – No data; roadway width 4.6 m (14 ft 11 in).	No data	Two span timber stringer bridge over creek.	Good
14	Mission Creek Road	579876	Mission Creek above well #204	10T 17W-2 way 25W-1 way military 2 lane	14.9 m (49 ft) long; overall width – No data; roadway width 5.7 m (18 ft 8 in).	No data	Two span timber stringer bridge over creek.	Good
15	Upper Milpitas Road	565939	Mission Creek above well #206	12T 14W 1 lane	18.6 m (61 ft) long; overall width – No data; roadway width 3.8 m (12 ft 5 in)	No data	Single span steel UCB beam, segmental bridge over creek.	Good
16	Lugo Road	614789	Upper Lugo Canyon #2	35T 50W 1 lane	14.8 m (48.5 ft) long; overall width – No data; roadway width 4 m (13 ft).	No data	Three span timber stringer bridge over creek.	Poor
17	Lugo Road	636784	Lower Lugo Canyon #1	40T 40W 1 lane	5.6 m (18 ft 6 in) long; overall width – No data; roadway width 3.6 m (11 ft 10 in).	No data	Single span timber stringer bridge over creek.	Fair
18	Los Bueyos Road	565735	Los Bueyos Creek	20T 32W 1 lane	15.5 m (51 ft) long; overall width – No data; roadway width 3.7 m (12 ft).	No data	Three span timber and steel stringer bridge over creek.	Good
19	Little Oak Flat Road	664677	El Piojo Creek	10T 12W 1 lane	9.4 m (31 ft) long; overall width – No data; roadway width 4.5 m (14 ft 10 in).	No data	Two span timber stringer bridge over creek.	Good
20	Salmon Creek Road and Summit Trail	619656	Tributary of Little Salmon Creek	16T 25W 1 lane	7.4 m (24 ft) long; overall width – No data; roadway width 3.4 m (11 ft 4 in).	No data	Two span timber stringer bridge over creek.	Good
21	Little Salmon Creek Road	621670	Pozo Hondo Creek	20T 25W 1 lane	15.5 m (51 ft) long; overall width – No data; roadway width 3.8 m (12 ft 5 in).	No data	Three span timber stringer bridge over creek.	Good
22	Little Salmon Creek Road	626681 Approximate	Steve Creek	18T 30W 1 lane	10.4 m (34 ft) long; overall width – No data; roadway width 4 m (13 ft)	No data	Three span timber stringer bridge over creek.	Good

2. RAILROADS

There are no Railroads on Fort Hunter Liggett Military Reservation.

3. AIRFIELDS

NAME; LOCATION; TYPE; AND CLASSIFICATION	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREAS DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
Hunter Liggett Army Airfield; Grid Reference 593850; Army; Airfield.	Elevation: 320 m (1050 ft) Status: Nonoperational, permanently closed to fixed wing aircraft, used as a permanent HLZ.	Runway: 1124 m (3688 ft) long, 22 m (72 ft) wide. Azimuth: 140° – 320° Weight Bearing Capacity: S93, T300, ST175, TT400, TDT775. Suface Material and Condition: Asphaltic concrete surface in good condition.	Taxiways: None Parking, Apron and Hardstand Areas: Two asphaltic concrete surface parking areas. Total area 6735 m^2 (72,500 ft^2). Maximum weight bearing capacity same as runway. Condition: Good	Heliport Hanger: One Dimensions: 24.4 x 15.2 m (80 x 50 ft) Construction Material: Steel	Types of fuel: Aviation fuel (Mil Specs) 115/145 grade; JP-4; grade D-1080 (Dispersant), reciprocating engine oil (Mil-L-22851 type III; 1005, jet engine oil (Mil-L-6081).	Control Tower: Height 6 m (20 ft). Communications: FSS Salinas SMS-NOTAM SNS. Instrument Landing System: Radio aids to Navigation. Lighting: Field lighting low intensity system.	Heliport located at airfield. Aerodrome is only partially covered by the USAF NOTAM system and maintains a military NOTAM file. (For complete aerodrome information civil NOTAMS must also be consulted). There are no aircraft authorized/assigned to Fort Hunter-Liggett. Buildings have been erected close to runway. A new airfield has been programmed for future construction to the east along Infantry Road.

NOTE: Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, TT, TDT and AUW. Runway weight bearing capacity given is for unlimited operations. Aircraft weights higher than given require prior permission from the aerodrome controlling authority.

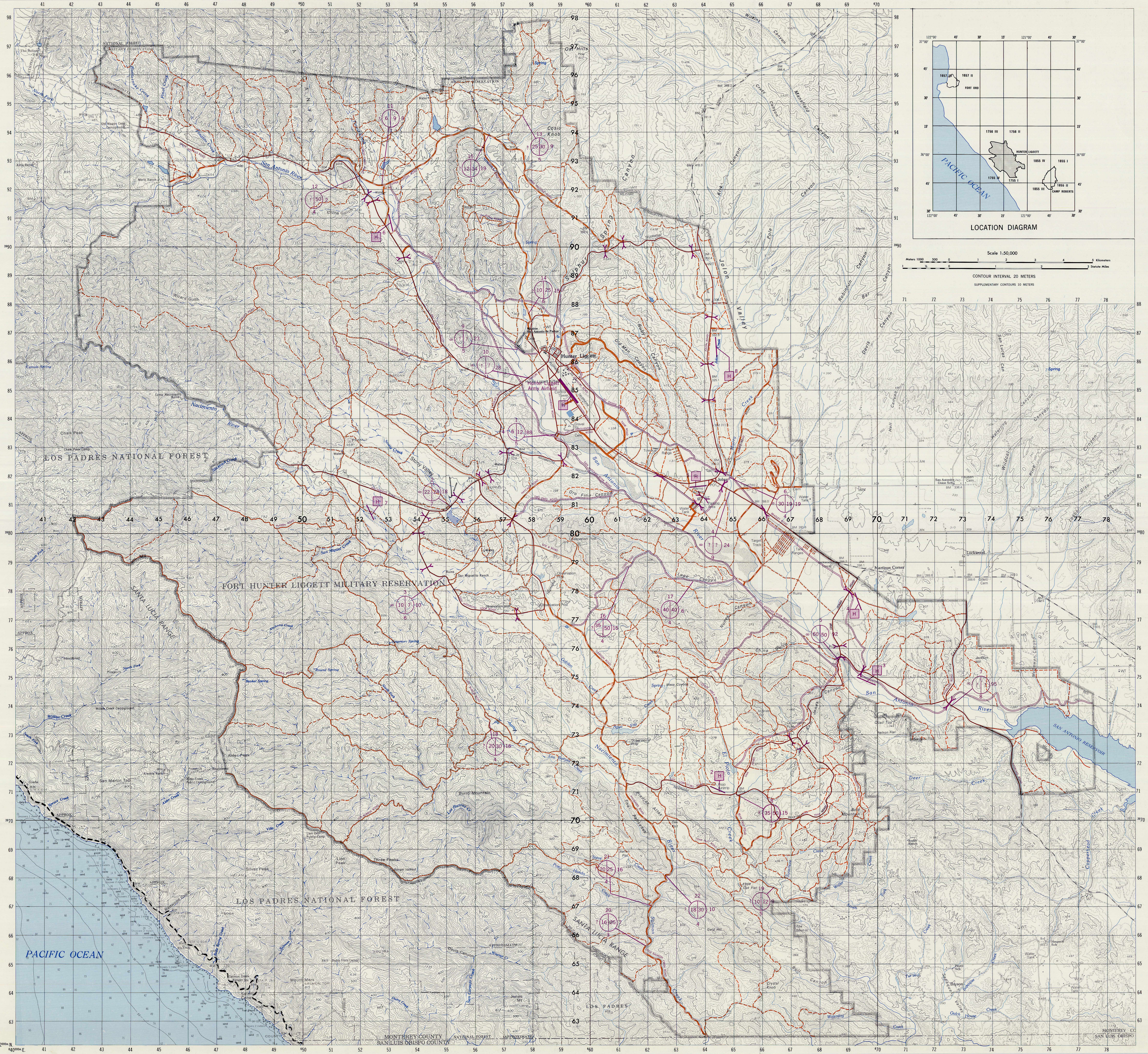
S---- Runway weight bearing capacity for aircraft with single-wheel type landing gear. (C-47), (F100), etc.
T---- Runway weight bearing capacity with twin-wheel type landing gear. (C-9A), etc.
ST--- Runway weight bearing capacity for aircraft with single-tandem landing gear (C-130).
TT--- Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear. (B-52), (C-135), etc.
TDT - Runway weight bearing capacity for aircraft with twin delta tandem landing gear. (C-5).
AUW- All up weight. Maximum weight bearing capacity for any aircraft irrespective of landing gear.

4. PIPELINES

There are no Pipelines on Fort Hunter Liggett Military Reservation.

5. HELICOPTER LANDING ZONES

MAP NUMBER AND NAME	LOCATION (GRID REFERENCE)	DIMENSIONS	AZIMUTH	ELEVATION	SURFACE MATERIAL	STATUS AND RESTRAINTS	REMARKS
1. Hunter Liggett Army Airfield	591845	Runway: 1124 m long; 22 m wide (3688 ft long; 72 ft wide) Apron: 14,562 m^2 (156,750 ft^2)	140° – 320°	320 m (1050 ft)	Portland cement concrete Asphaltic concrete	Control Tower, 6 m (20 ft) high. Scheduled for replacement by a larger structure. Closed completely to fixed wing aircraft. Used as HLZ only. New buildings close to runway.	Runway and apron both in good condition. Aerodrome is only partially covered by the USAF NOTAM system and maintains a military NOTAM file. (For complete aerodrome information, civil NOTAMS must also be consulted).
2. Piojo Airstrip	645711	Runway: 663 m long; 20 m wide (2175 ft long; 65 ft wide)	115° – 295°	341 m (1120 ft)	Dirt and grass natural surface.	Used only as HLZ.	Fair condition
3. Tule Airstrip	697750	Runway: 606 m long; 12 m wide (1970 ft long; 40 ft wide)	110° – 290°	256 m (840 ft)	Dirt and grass natural surface.	Used only as HLZ.	Fair condition
4. Martinus Airstrip	694777	Runway: 692 m long; 15 m wide (2270 ft long; 50 ft wide)	160° – 340°	280 m (920 ft)	Dirt and grass natural surface.	Used only as HLZ.	Fair condition
5. Almo Airstrip	638817	Runway: 561 m long; 24 m wide (1840 ft long; 78 ft wide)	085° – 265°	288 m (945 ft)	Dirt and grass natural surface	Completely closed to all aircraft. Powerlines too close to runway.	Fair condition
6. Upper Milpitas Airstrip	531909	Runway: 660 m long; 30 m wide (2000 ft long; 100 ft wide)	165° – 345°	354 m (1160 ft)	Dirt and grass natural surface.	Fenced off from surrounding country-side. Used as HLZ, and by U.S. Forest Service for its light planes.	Fair condition
7. Patent Airstrip	524809	Runway: 390 m long; 12 m wide (1280 ft long; 40 ft wide)	150° – 330°	390 m (1280 ft)	Dirt and grass natural surface.	Used only as HLZ.	Fair condition. Formerly called Stony Valley Airstrip, with name still appearing on some maps.
8. Jolon Airstrip	6438866	Runway: 945 m long; 27 m wide (3100 ft long; 90 ft wide)	160° – 340°	329 m (1080 ft)	Dirt and grass natural surface.	Used only as HLZ.	Poor condition



HUNTER LIGGETT, CALIFORNIA TERRAIN ANALYSIS

LINES OF COMMUNICATION

ROADS

- Hard surface, 2 or 3 lanes
- Loose surface, 2 or more lanes
- Hard surface, 1 lane
- Loose surface, 1 lane
- Improved dirt
- Unimproved dirt
- Tank trail
- Tank crossing

BRIDGE DATA
(measurements in meters)

A. Bridge number
B. One-way military load classification; (T) tracked
C. One-way military load classification; (W) wheeled
D. Roadway width
E. Length
F. Vertical clearance
∞ Unlimited vertical clearance
? No data available

AIRFIELDS/AIRSTRIPS

- Airfield
- Airstrip

HELICOPTER LANDING ZONES

H 1 Landing zone

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

K. URBAN AREAS (CANTONMENT AREA)

TROOP BILLETS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
Permanent	2	1506	Good	Built in 1972 and 1977, with 202 and 1304 man capacities respectively. Housing is being improved to meet habitability standards during the FY 78–82 time period. Hutments are sited in several areas and recommended for retention only until planned permanent construction can replace them. Since these are inadequate by present housing standards, demolition has already been ordered on 154 of these. This will decrease total capacity by 1757 spaces. There are 15 temporary concrete tent floor pads with a capacity of 120 spaces.
Temporary	4	105	Good	
Hutments	194	2077	Poor	
Totals	200	3688		There are presently 1450 permanent personnel assigned to the post. If the proposal for the relocation of the Combat Developments Experimentation Command (CDEC) Headquarters here is carried through, total permanent personnel would be raised to 3000 and a massive building program would be needed to accommodate them.

BACHELOR QUARTERS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
			BACHELOR OFFICER QUARTERS	
Permanent	1	50	Good	Completed June 1970; of the 50 spaces, 49 are used as VOQ's.
Temporary	8	94	Good	Temporaries are recommeded for retention only until planned permanent construction will permit their demolition. Scheduled for FY 80 is another BOQ with 62 spaces.
Totals	9	144		
			BACHELOR ENLISTED QUARTERS	
None				A 120-man senior bachelor enlisted quarters without mess is proposed.

FAMILY QUARTERS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
			OFFICER, NCO, AND CIVILIAN FAMILY HOUSING	
TYPE	NUMBER FAMILY UNITS	NUMBER OF BUILDINGS	CONDITION	
Field grade: Permanent	1	1	Good	The Hacienda building houses the quest quarters, officers club, and officers open mess. This quarters of the building will be converted to BOQ use upon construction of MCA family housing.
Temporary	1	1	Poor	Remaining units are old, generally inadequate, ranch houses built prior to acquisition of the post.
Company Grade: Temporary	3	3	Poor	Adequate rental units for family housing are nearly nonexistent within reasonable commuting distance. Even available sub-standard units are often difficult to find.
NCO Grade: Temporary	3	3	Poor	Although the security of housing in the surrounding areas is a serious problem, the low population does lead to a healthy environment.
Civilian Grades: Temporary	1	1	Poor	A civilian dormitory without mess has been proposed.
Total Family Quarters	9	9		No new housing is planned before 1980.
			GUEST HOUSING	
Permanent	4 units	1	Good	These units are in the Hacienda building.

General Note: The only other place on post which has full time facilities is Jolon. There is the Lost Ruby Mine Saloon/Restaurant, a general store, a gas station, a car wash, a laundromat, and approximately 90 house trailers. Also, along King City Road and near Lockwood there are about 57 additional house trailers.

UTILITIES

CAPACITY AND CURRENT LOAD	REMARKS
ELECTRIC POWER	
Electric power is supplied through 12 KV, three-phase line from King City and San Miguel substations. Distribution of electrical power is 12,000 volts, three-phase, 60-cycle, three-wire. Peak demand is 853 KW. Capacity is 1442 KW. Maximum power deliverable per year is 12,631,920 KWH or 1,052,660 KWH/month. Peak power consumption per year is 7,052,160 KWH or 578,680 KWH/month. In 1974, average power consumption was 512,666 KWH/month. Three temporary electric power plants, gas fueled, with 136 KW capacity are available. There is a 15 KW stand-by general plant also available.	Electric power supplied by the Pacific Gas and Electric Company. The electrical distribution system is in fair to good condition and will be adequate to serve current needs. CDEC experimentation sites are served by portable generating plants. Increase in power requirements cannot be provided by this system, which is marginal for existing facilities and will be inadequate if new facilities are added. 19,000 linear feet of the existing system is scheduled for upgrading by 1982.
LIQUID PROPANE GAS (LPG)	
An average of 155,197 liters (41,000 gals) of propane is consumed per month. Peak consumption per month is 218,720 liters (57,786 gals). There are 49 contractor-owned storage tanks and 15 government-owned tanks in use, for a total storage capacity of 193,035 liters (51,000 gals).	Liquid propane gas (LPG) purchased from Buck Butane Service with offices in San Jose and King City, and fuel oil are used for heating, as natural gas is not available. The nearest natural gas line is 40 kilometers (25 miles) from the cantonment area. It is across prohibitive terrain and fully committed. Recent contracts indicate adequate supplies will be available for the foreseeable future.
OIL	
Fuel oil for FY 74 provided 26.1 percent of the heat energy used on post. Total storage capacity was 94,632 liters (25,000 gals). Total energy consumption for 1974 was 82.1 billion BTU, which was supplied by: 78,000 gals – Fuel oil #1 37,500 gals – Diesel oil #2 493,685 gals – LPG 6,152,000 KWH – Electric.	Fuel oil had been recently phased out of use. However, by DA Directive, new buildings must use fuel oil for heating. The new barracks are now heated with fuel oil, but there is no experience by which to measure use. New large projects will use number 2 fuel oil. Six LPG units rated above 750,000 BTUH must be converted to fuel oil by 1978. Some have already been replaced.

UTILITIES (Continued)

CAPACITY AND CURRENT LOAD	REMARKS
WATER SUPPLY	
Water sources are 20 wells, 15 with pumping stations (12 presently in use), and 23 temporary storage facilities. Of several wells drilled in the Headquarters-Airfield Areas, only two can be considered to have reasonably good production. The wells have a rated capacity of 5045 liters per minute (1333 gpm), and are normally adequate for an average maximum daily flow of 4837 liters per minute (1278 gpm) or 3,785,000 liters per day (1,000,000 gpd). Peak water consumption is 2,271,000 liters per day (600,000 gpd). The 23 temporary storage facilities have a total capacity of 4,560,925 liters (1,205,000 gals). Hq. area has 3,785,000 liters (1,000,000 gals) in a reservoir and 227,100 liters (60,000 gals) in a steel tank; other storage equals 548,825 liters (145,000 gals). The water consumption for Fiscal Year (1975) was an average of 29,994,581 liters (7,924,000 gals) per month.	All water produced is chlorinated at the pumps. Many of the wells have a very limited capacity during the summer months. For permanent requirements, the present system is inadequate. New wells are needed, as water is sometimes hauled in by truck. Water is naturally fluoridated, but calcium buildup in pipes can be a problem. Estimated future demand will be 2,528,948 liters per day (668,150 gpd) at an average rate of 1756 liters per minute (464 gpm) with peak rate of 4391 liters per minute (1160 gpm) or 3,689,883 liters per day (974,807 gpd). A ground storage tank reservoir of 757,000 liters (200,000 gals) at the airfield and well head storage of 567,750 to 757,000 liters (150,000 – 200,000 gals) are recommended.
SEWERAGE	
Fort Hunter-Liggett is served by a primary treatment plant constructed in 1972. This system has a design capacity of 3,785,000 liters (one million gallons). Peak load is 514,760 liters per day (136,000 gpd), and average load is 227,100 liters per day (60,000 gpd). The bivouac areas depend on septic tanks or pit latrines for disposal of sewage. The four septic tank drainage fields have a capacity of 106,000 liters (28,000 gals). A temporary sewage treatment plant with a capacity of 284,000 liters (75,000 gals) was built in 1959.	The main plant has two aeration lagoons. At present, it is used at only a fraction of its rated capacity. The present plant will meet all present and foreseeable future demands.
TELECOMMUNICATIONS	
The signal wire communications network presently consists of approximately 869 kilometers (540 circuit miles) of military open wire pole line construction of various types, 1850 kilometers (1150 circuit miles) of buried cable, and 3500 kilometers (2175 circuit miles) of aerial cable. The switchboard is a three-position, 800-line, all-dial system of commercial design. There are 102 lines connected to the commercial exchange at King City. The cable vault in building 169 connects all on-post phones, except a few commercial pay phones, with the switchboard. About 100 of the lines can be used at the same time. There are 16 in and out lines connected directly to Fort Ord. Eight Autovon lines are available. Radio Transmitter, 50 watt, is located in building 488 on Hill 1400 east of the Hq. areas.	All telephone facilities are Government-owned except for fifty civilian lines using military pole line construction as carriers. The wire networks connects the principal bivouac areas, firing ranges, and artillery observation posts with headquarters through a three-position dial switchboard located in CDEC Control Headquarters, building #T197. Communications system is generally adequate for present needs, but considerable modification and enlargement will be required for planned new construction. A new 6 position switchboard with automatic dial system, data servicing, teletype facilities, and communication administration is proposed for near the Post Hq.

SCHOOL FACILITIES

TYPE	CAPACITY	REMARKS
Elementary	N/A	Army provides transportation for elementary children to Jolon. There a school bus picks up the children for transportation to the San Antonio School at Lockwood (five miles southeast of Jolon).
High School	N/A	Older children attend King City Union High School at King City. An estimated three schools will be needed: elementary with 849 spaces, junior high with 355 spaces, and high school with 340 spaces. A dependents nursery school is also proposed.

MEDICAL FACILITIES

TYPE	CAPACITY	REMARKS
Dispensary	12 bed	Two temporary dispensaries, building #145 with 12 beds and building #10 without beds. Planned for completion in FY 80 is a dispensary/dental clinic with 6 dental chairs and 4 beds of 1626 m^2 (17,500 ft^2).

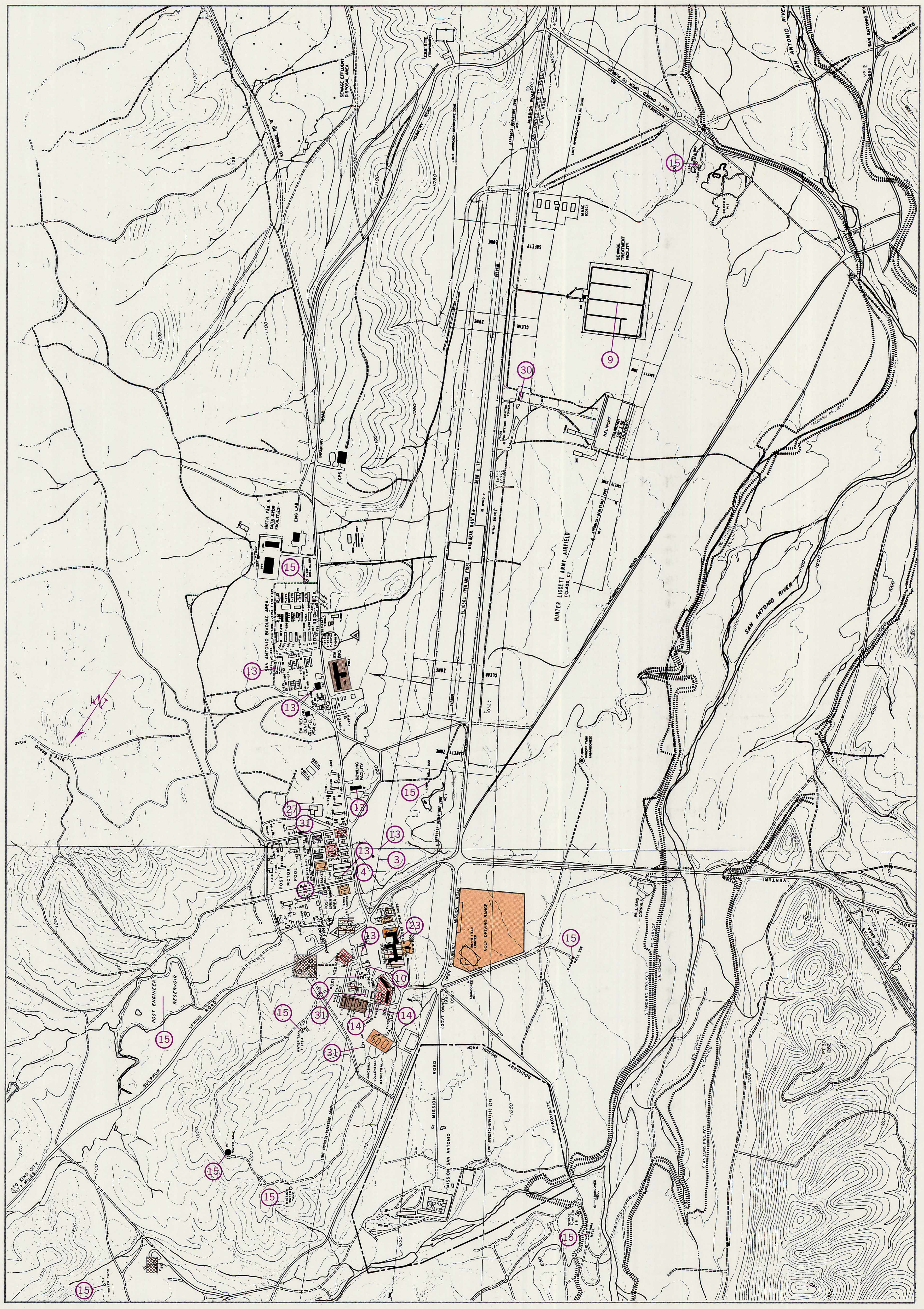
RECREATION FACILITIES

TYPE	NUMBER	REMARKS
Bowling Center	1 Permanent	Building #121 is a permanent facility 518 m^2 (5580 ft^2), 6 lanes, built in 1974.
Swimming Pool	1 Permanent	The heated outdoor swimming pool is located near the Hacienda Building.
Baseball/Football	1 Permanent	This facility includes field lights.
Tennis Court	2 Permanent	This facility includes field lights.
Golf Driving Range	1 Permanent	
Theater	1 Permanent	New Facility built in 1976 with 350 seats.
General Development facility	1 Permanent	Building #191 is a permanent facility 156 m^2 (1680 ft^2), built in 1975. A new GED facility is scheduled for FY 82.
Recreation Building	1 Permanent	Building #287, built in 1974, has 519 m^2 (5584 ft^2).
Gymnasium	1 Semi-permanent	Building #144 has 666 m^2 (7172 ft^2) was built in 1940.
Multiple Purpose Courts	8 Permanent	

Note: Proposed due to expansion are an EM service club, NCO club, Officer's open mess with pool, NCO mess and pool, recreation center (gymnasium ball field, outdoor play courts), skill development center, community pool, outdoor recreation facilities for the family housing area, recreation workshop, and a nine-hole golf course.

FORT HUNTER LIGGETT, CALIFORNIA

URBAN AREAS (CANTONMENT AREAS)



MAIN POST

AREA FEATURES

- Family Housing, Officers
- Family Housing, NCO
- Barracks, Troop Quarters
- Bachelor Officers Quarters Male/Female
- Guest House
- Recreation Facilities

SITE FEATURES

- 1 Post Headquarters
- 3 Post Exchange
- 4 Post Office
- 5 Post Engineers (DFAE)
- 9 Sewage Treatment Plant
- 10 Fire Station
- 13 Indoor Recreation
- 14 Health Facility
- 15 Water Facility
- 23 Officers Open Mess
- 27 Telephone Exchange
- 30 Field Operations (Airfield)
- 31 NCO Club

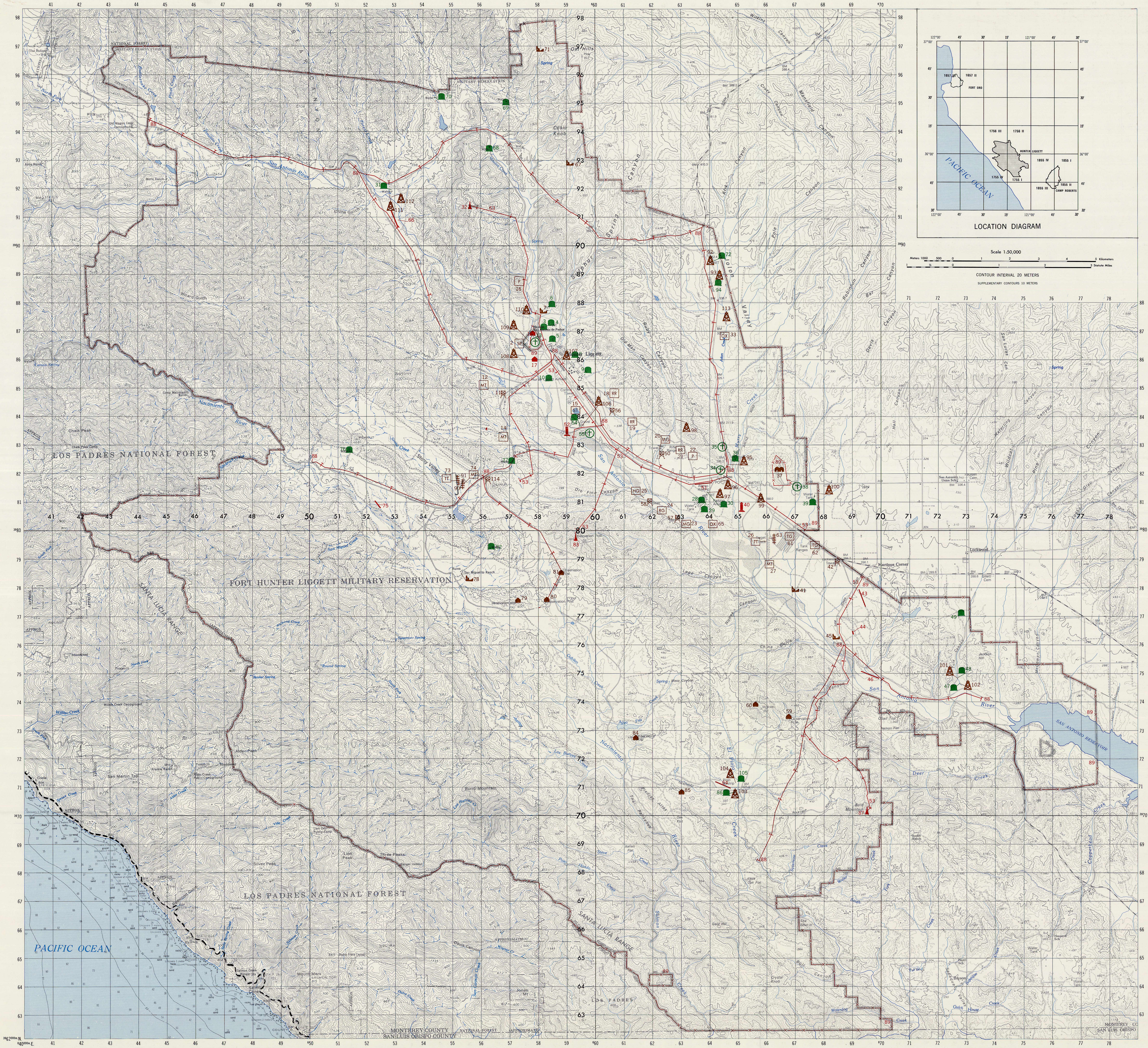
LOCATION DIAGRAM

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

L. NON-URBAN CULTURE FEATURES

On the Fort Hunter Liggett Reservation, there are approximately 114 man-made features outside the cantonment area which could affect military training or operations either positively or negatively. Most of these features, depicted on the accompanying map and described below, consist of buildings, water tanks, landing strips and range towers. The man-made features included are those that existed as of September 1976.

MAP NUMBER	GRID REFERENCE	DESCRIPTION
1	578869	San Antonio Mission, length 81.4 m (267 ft), width 81.4 m (267 ft), height-upper wall 8.5 m (28 ft) lower 3 walls 6.4 m (21 ft).
2	574866	Sewage Pump Station, height 3.1 m (10 ft)
3	582871	Mission Water Tank, height 3.8 m (12.5 ft), diameter 13 m (42 ft)
4	584872	Water Tank, storage capacity 3,785,283 liters (1,000,000 gal), height 4.5 m (15 ft), diameter 24 m (80 ft)
5	585867	Water Tank, elevated, storage capacity 227,117 liters (60,000 gal), height 4.5 m (15 ft), diameter 24 m (80 ft)
6	585879	Water Tank, elevated, storage capacity 18,926 liters (5000 gal), height 11.3 m (37 ft)
7	581876	Ruins
8	593853	Water Tanks, two, elevated, storage capacity 18,926 liters (5000 gal) each
9	598856	Water Tank, storage capacity 8328 liters (2200 gal)
10	584853	Imhoff Tank (abandoned), height 4.6 m (15 ft)
11	568848	Tower, height 10 m (33 ft)
12	561851	Small Arms Moving Range
13	579868	Cemetery
14	568833	Small Arms Moving Range
15	593842	Sewage Treatment Facility
16	574887	Pistol Range
17	579860	Pumphouse and Adjoining Well, no data
18	606843	Rifle Range
19	613838	Rifle Range
20	623829	Machine Gun Range
21	630828	Known Distance (KD) Rifle Range (abandoned)
22	634826	Pistol Range (abandoned)
23	632802	Machine Gun Range
24	624807	Rifle Grenade Range
25	617811	Hand Grenade Range
26	660796	Target Track Range on narrow gauge railroad
27	661788	Moving Target Range
28	637810	Water Tank, storage capacity 18,926 liters (5000 gal), height 2.4 m (8 ft)
29	639810	Water Tank, storage capacity 37,853 liters (10,000 gal), height 8.5 m (28 ft)
30	639813	Water Tanks, two, storage capacity 18,926 liters (5000 gal) each
31	529919	Water Tanks, two, storage capacity 37,853 liters (10,000 gal) each height 5 m (16 ft)
32	556914	Instrumentation Site; heliport
33	645868	Oxidation Ponds, two ponds, first is 103.6 m (1340 ft) x 28.3 m (93 ft) and second is 64 m (2210 ft) x 213 m (70 ft)
34	644821	Cemetery
35	644829	Cemetery
36	649825	Water Tank, storage capacity 18,925 liters (5000 gal)
37	665821	Magazine Area, fifteen General Purpose Magazines – six 109.7 m^2 (1180 ft^2), six 76.2 m^2 (820 ft^2), and three 39.0 m^2 (420 ft^2)
38	671815	Cemetery
39	677812	Water Tank, storage capacity 18,925 liters (5000 gal), height 8.8 m (29 ft)
40	651808	Silo, height 7 m (23 ft)
41	670779	Ruins
42	685789	Tower, height 6.1 m (20 ft)
43	694777	Martinus Airstrip, 692 m (2270 ft) x 15 m (50 ft), dirt, (abandoned). Used as a helicopter landing zone.
44	690764	Drone Strip, 89.6 m (294 ft) diameter
45	685762	Ruins
46	697750	Tule Airstrip, 606 m (1990 ft) x 12 m (40 ft), dirt, (abandoned). Used as a helicopter landing zone.
47	728746	Water Tank, no data
48	727748	Water Tank, storage capacity 37,853 liters (10,000 gal), height 7.6 m (25 ft)
49	728771	Water Tank, height 4.3 m (14 ft)
50	623829	Tower, height 8.5 m (28 ft)
51	638817	Alamo Airstrip, 561 m (1840 ft) x 24 m (78 ft), dirt, (abandoned)
52	590835	Silo, no data
53		Electric Power Lines:
	From 556913 To 674800	12 KV; three-phase line
	From 585858 To 574817	12 KV; three-phase line
	From 608828 To 593798	12 KV; three-phase line
	From 695702 To 694784	12 KV; three-phase line
54	595836	Water Tank, height 3.1 m (10 ft)
55	598834	Cemetery
56	606842	Lookout tower for rifle range, height 2.6 m (8.5 ft)
57	629804	Tower, height 4.5 m (15 ft)
58	619810	Tower, height 4.5 m (15 ft)
59	668734	Observation Post, in ground, earth covered concrete bunker
60	656739	Observation Post, in ground, earth covered concrete bunker
61	668798	B-9 Ranges
62	677795	Tank Ranges
63	661797	Revetments, length 803 m (2635 ft)
64	645711	Piojo Airstrip, 663 m (2175 ft) x 20 m (65 ft), dirt, (abandoned). Used as a helicopter landing zone.
65	640805	Oxidation Ponds, two ponds, first is 113.4 m (372 ft) x 34.4 m (113 ft) and second is 81.7 m (268 ft) x 23.8 m (78 ft)
66	531909	Upper Milpitas Airstrip, 660 m (2000 ft) x 30 m (100 ft), dirt, (abandoned). Used as a helicopter landing zone.
67	591929	Ruins
68	563934	Water Tank, no data
69	569950	Water Tank, height 3.1 m (10 ft)
70	544952	Water Tank, height 3.1 m (10 ft)
71	581968	Ruins
72	641894	Water Tank, elevated, storage capacity 18,925 liters (5000 gal), height 6.1 m (20 ft)
73	552817	Target Track Range, (abandoned)
74	554816	Moving Target Range, (abandoned)
75	524809	Stony Valley Airstrip, 390 m (1280 ft) x 12 m (40 ft), dirt, (abandoned). Used as a helicopter landing zone.
76	514828	Water Tank, no data
77	571824	Water Tank, height 5.8 m (19 ft)
78	553785	Ruins
79	573775	Observation Post, in ground, earth covered concrete bunker
80	583775	Observation Post, in ground, earth covered concrete bunker
81	588785	Observation Post, in ground, earth covered concrete bunker
82	564794	Water Tank, height 5.5 m (18 ft)
83	593797	Instrumentation Site, no data
84	614727	Observation Post, in ground, earth covered concrete bunker
85	630708	Observation Post, in ground, earth covered concrete bunker
86	649708	Water Tank, no data
87	695702	Instrumentation Site, no data
88		Overhead Telephone Cables:
	From 444945 To 518925	Pairs unknown
	From 518925 To 637907	Pairs unknown
	From 518925 To 586861	Pairs unknown
	From 586861 To 646823	51 pairs of cables
	From 602837 To 501824	Pairs unknown
	From 646823 To 637907	51 pairs of cables
	From 561819 To 583775	Pairs unknown
	From 687760 To 658684	51 pairs of cables
	From 687760 To 735742	Pairs unknown
89		Fences:
	From 624644 To 624644	Fence, barbed wire, approximate height 1.2 m (4 ft). Ranch in southern part of post.
	From 777731 To 777717	Fence, barbed wire, approximate height 1.2 m (4 ft). Around entire perimeter of post, except for part of river. During the recent drought period, fires have destroyed some sections of the boundary fence and these have not yet been replaced because of the expense involved.
	From 579863 To 579863	Fence, barbed wire, approximate height 1.2 m (4 ft), around San Antonio Mission land.
	From 667823 To 667823	Fence, barbed wire, approximate height 1.2 m (4 ft), around magazine area.
90	552817	Revetment, approximate length 800 m (2624 ft)
91	554816	Revetment, approximate length 318 m (1042 ft)
92	641894	Water Well-203, maximum daily capacity 18,100 liters (4800 gal), intermittent production
93	644889	Water Well-203A, housing building height 2.9 m (9.5 ft), maximum daily capacity 81,800 liters (21,600 gal), intermittent production.
94	643887	Water Tank, storage capacity 227,000 liters (60,000 gal)
95	647823	Water Well-210, maximum daily capacity 63,600 liters (16,800 gal), intermittent production.
96	644817	Water Well-213, maximum daily capacity 272,500 liters (72,000 gal), intermittent production, at Miller Ranch
97	639813	Water Well-212, maximum daily capacity 36,300 liters (9600 gal), intermittent production, presently inactive
98	628839	Water Well-219, maximum daily capacity-no data, intermittent production presently inactive
99	658811	Water Well-380, maximum daily production 2,543,500 liters (672,000 gal)
100	677813	Water Well-211, maximum daily production 63,600 liters (16,800 gal), intermittent production
101	727748	Water Well-Tule #2, maximum daily production 272,500 liters (72,000 gal), intermittent production, high sulfur-not used for drinking
102	728746	Water Well-Tule #1, maximum daily capacity-no data, intermittent production, presently inactive
103	649708	Water Well-216A, maximum daily capacity-no data, intermittent production, presently inactive.
104	649711	Water Well-216, maximum daily capacity 54,500 liters (14,400 gal), intermittent production
105	651712	Water Tank, storage capacity 75,700 liters (20,000 gal)
106	595836	Water Well-207, maximum daily capacity 63,600 liters (16,800 gal), intermittent production, presently inactive.
107	586859	Water Well-222, maximum daily capacity 236,200 liters (62,400 gal)
108	576861	Water Well-236, maximum daily capacity 908,400 liters (240,000 gal)
109	577866	Water Well-206, maximum daily capacity 90,800 liters (24,000 gal), intermittent production, presently inactive
110	577877	Water Well-204, maximum daily capacity 181,700 liters (48,000 gal), intermittent production, presently inactive
111	528918	Water Well-201, maximum daily capacity 36,300 liters (9600 gal), intermittent production, dry in summer
112	529917	Water Well-201B, maximum daily capacity 36,300 liters (9600 gal), intermittent production, presently inactive
113	646872	Water Well-Milpitas #2, maximum daily capacity 408,800 liters (108,000 gal), intermittent production
114	562818	Observation Tower, height 2.6 m (8.4 ft)



HUNTER LIGGETT, CALIFORNIA
TERRAIN ANALYSIS

NON-URBAN CULTURE FEATURES

- Building
- SP Sewage Pump Station
- Water Tank
- Ruins
- Tower (Lookout, Fire, Guard, Observation)
- P Pistol Range
- RR Rifle Range
- MG Machine Gun Range
- TG Tank Gunnery Range
- HG Hand Grenade Range
- RG Rifle Grenade Range
- TT Target Track
- MT Moving Target
- Cemetery
- ST Sewage Treatment Facility
- Instrumentation Site
- OX Oxidation Ponds
- Ammunition Storage
- Silo
- Abandoned Airstrip
- Power Line
- Observation Post/Bunker
- Revetment
- Overhead Telephone Cables
- Fence
- Water Wells

NOTE: Number on map refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

CAMP ROBERTS

A. SURFACE CONFIGURATION

Camp Roberts is located in central California in the Salinas River Basin; it is part of the California Coast Range section of the Pacific Border physiographic province. Landforms consist of flat to strongly rolling plains on most of the reservation except in the southwestern corner where low, round to moderately dissected hill surfaces predominate. The lower, flat to gently rolling plain surfaces, commonly found in the flood plains of the major rivers, separate the higher plain surfaces on most of the reservation. Stream valleys generally trend northward or southward.

MAP UNIT	LANDFORM	LANDFORM DESCRIPTION AND DISTRIBUTION	ELEVATION
1	Low Plains	Flat to gently rolling surfaces predominate in the flood plains of the San Antonio, Nacimiento and Salinas Rivers; two other areas of more rolling surfaces are in the southeast between the Nacimiento and Salinas Rivers and the upper course of a tributary of San Marcos Creek. Some stream dissection occurs on the edges of the flood plains and sandy areas are common in braided dry channels of the rivers. No rock outcrops occur. Local relief reaches up to about 25 m (82 ft) and slopes are largely between 0 and 3%, but reach 8% along edges of flood plains and the more rolling areas.	Elevations mostly between 183 and 213 m (600 and 700 ft) above sea level. Lowest elevation, 161 m (528 ft), located in the northwestern corner of the unit near the intersection of the Nacimiento and the Salinas Rivers. Highest elevation, about 291 m (954 ft), located at the intersection of Generals and Perimeter Roads in the northeastern corner of the reservation.
2	High Plains	Gently to strongly rolling, smooth to moderately dissected surfaces throughout the reservation are generally between or adjacent to flood plain areas. Some rock outcrops occur. Most valleys trend northward or southward. Local relief is mainly between 50 and 75 m (164 and 246 ft); slopes are commonly 8 to 15%.	Elevations are largely between 244 m and 305 m (800 and 1000 ft) above sea level. Lowest elevation, about 171 m (560 ft), near the intersection of the Nacimiento and Salinas Rivers in the northwestern corner of the reservation. Highest elevation, 413 m (1353 ft), located near San Marcos Road in the extreme southern reaches of the reservation.
3	Low Hills	Round to moderately dissected hill surfaces predominate in the southwestern corner of the reservation. V-shaped valleys commonly trend eastward and northeastward. Rock outcrops occur locally. Local relief is generally between 150 and 170 m (492 and 558 ft); slopes are largely about 30%, locally 45%.	Elevations are largely between 305 m and 427 m (1000 and 1400 ft) above sea level. Lowest elevation, about 183 m (600 ft), on the Nacimiento River in the northern part of unit. Highest elevation, 501 m (1643 ft), located near Godfrey Road in extreme southern part of unit.

B. SURFACE DRAINAGE

All of the surface drainage of Camp Roberts flows into the Salinas River and its tributaries, the Nacimiento and the San Antonio Rivers. The Nacimiento River traverses Camp Roberts from west to east for approximately 16 km (10 mi) in the central low plains region, flowing in a northeasterly direction. This river, with its relatively long tributaries, drains approximately 70% of Camp Roberts and empties into the Salinas River near the East Garrison. The San Antonio River flows in a northeasterly direction, roughly along the northwestern boundary of Camp Roberts for approximately 5 km (3 mi). It receives a small portion of Camp Roberts' drainage before it empties into the Salinas River at Bradley. The Salinas River enters Camp Roberts along the eastern boundary in a low plains region near the Main Garrison. It flows through the reservation in a northwesterly direction for approximately 12 km (7.2 mi) before crossing the northwestern boundary at Bradley. Each river system is characterized by braided, wandering channels with relatively broad flood plains that are in most cases approximately 1.6 km (1 mi) wide. Discharge rates for the Nacimiento and the San Antonio Rivers are controlled by reservoirs of the same names, a short distance west of Camp Roberts. During the summer months virtually all tributaries are dry except for the flow from an occasional spring. Flash flooding is not a problem on Camp Roberts.

DRAINAGE CHARACTERISTICS

DRAINAGE CATEGORIES	GENERAL	REGIME	WIDTHS	DEPTHS	VELOCITY AND DISCHARGE	BANKS	BOTTOMS
Watercourses Salinas River	Perennial stream that flows through fairly wide, often gradually sloped flood plain. Braided stream channels wander in a northwesterly direction.	High water months are December through April and low water months are May through November.	Mostly about 25 m (83 ft).	Mostly less than 1 m (3.3 ft).	Mostly drains beneath surface, however, velocity of surface flow generally less than 1.0 m/sec (3.3 ft/sec). Discharge at Paso Robles about 5.7 m^3/sec (198 ft^3/sec) from December to April. Average discharge from May through November about 0.136 m^3/sec (5 ft^3/sec).	Mostly sand with some gravel. Generally less than 2 m (6.6 ft) high.	Mostly sand with some gravel.
Nacimiento River	Perennial stream that flows in a northeasterly direction through broad flood plains. Braided channels empty into the Salinas River at the East Garrison.	Discharge is strongly influenced by upstream dam and not representative of seasonal drainage. Regionally, low water months are May through November and high water months are December through April.	Mostly about 20 m (66 ft).	Mostly less than 1.0 m (3.3 ft).	Velocity generally less than 1.0 m/sec (3.3 ft/sec). Discharge controlled by upstream reservoir and averages 6 m^3/sec (211 ft^3/sec) October through May and from June through September averages 11.2 m^3/sec (397 ft^3/sec).	Sand and gravel. Generally less than 2 m (6.6 ft) high.	Sand and gravel.
San Antonio River	Perennial stream that flows in a northeasterly direction through broad flood plains. Braided channels empty into the Salinas River at Bradley.	High water months are December through April and low water months are May through November.	Mostly about 20 m (66 ft).	Mostly less than 1 m (3.3 ft).	Velocity generally less than 1.0 m/sec (3.3 ft/sec). Discharge controlled by upstream reservoir. Stream characteristically similar to the Nacimiento River.	Sand and gravel. Generally less than 2 m (6.6 ft) high.	Sand and gravel.
Other streams	Ephemeral streams and tributaries throughout reservation.	Water flows during and for several hours after heavy rains.	Mostly less than 1.0 m (3.3 ft).	No data available.	No data available.	Mostly sand and some gravel.	Mostly sand and some gravel.
Standing Bodies of Water Reservoirs (See table below)							

MEAN MONTHLY DISCHARGE

m^3/sec (ft^3/sec)

MONTH	*NACIMIENTO RIVER DEL NACIMIENTO DAM NEAR BRADLEY, CA. (OCT 1957 to SEPT 1976)	SALINAS RIVER AT PASO ROBLES, CA. (OCT 1939 to SEPT 1976)
January	5.35 (189)	5.32 (188)
February	10.31 (364)	8.16 (288)
March	6.94 (245)	8.41 (297)
April	6.49 (229)	4.84 (171)
May	7.11 (251)	0.59 (21)
June	9.63 (340)	0.08 (3)
July	12.35 (436)	-0- (-0-)
August	12.63 (446)	-0- (-0-)
September	10.39 (367)	0.06 (2)
October	6.88 (243)	0.11 (4)
November	3.00 (106)	0.11 (4)
December	1.81 (64)	1.30 (46)

*Figures strongly influenced by discharge from upstream dam and not representative of seasonal drainage.

RESERVOIRS

MAP NUMBER	*NAME	GRID COORDINATES	APPROXIMATE HECTARES (ACRES)
1	[Garrison Lake]	027655	2.2 (4.8)
2	[Hellman Lake]	012608	2.2 (4.8)
3		013586	0.9 (2.0)
4	[Perimeter Road Lake]	050595	1.0 (2.2)
5		996596	3.0 (6.6)
6		030596	0.9 (2.0)

*Bracketed names assigned to unnamed reservoirs for clarity.

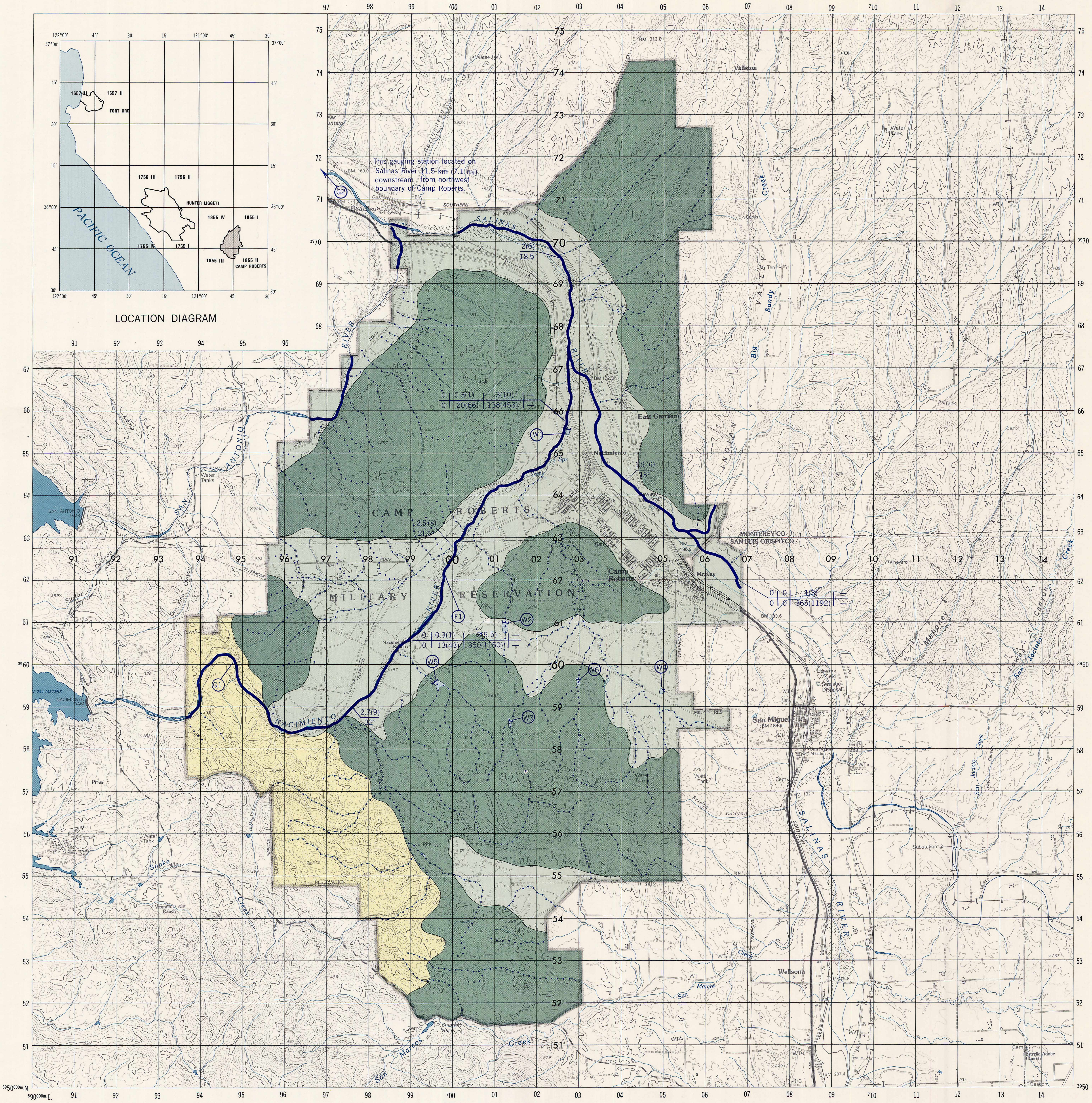
MAXIMUM STREAM DISCHARGE

GAGING STATION MAP NO.	STREAM NAME	DRAINAGE AREA ABOVE GAGE km^2 (mi^2)	RECORDING PERIOD	MAXIMUM MEAN MONTHLY DISCHARGE m^3/sec (ft^3/sec)	DATE
1	Nacimiento River Bel Nacimiento Dam neár Bradley, CA.	824 (322)	OCT 1957 - SEPT 1976	73 (2591)	FEB 1969
*	Salinas River at Paso Robles, CA.	998 (390)	OCT 1939 - SEPT 1976	56 (1980)	APR 1958

*Salinas River gaging station not shown on map. It is located at Paso Robles, 4.8 km (3 mi) northwest of Camp Roberts boundary.

FORD

MAP NO.	GRID COORDINATES	APPROXIMATE DEPTH m (ft)	APPROXIMATE LENGTH m (ft)	APPROXIMATE WIDTH m (ft)	BOTTOM COMPOSITION	APPROACHES COMPOSITION AND CONDITION	REMARKS
1	998662	0.3 (1)	120 (394)	4 (13)	Sand and gravel	Sand, easy	Vehicular ford



CAMP ROBERTS, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

SURFACE CONFIGURATION

1	**LOW PLAINS**	Predominantly flat to gently rolling in flood plains and gently to moderately rolling plains elsewhere. Local relief mainly between 12 and 46m; with slopes less than 8%.
2	**HIGH PLAINS**	Predominantly moderately rolling to hillocky plains. Local relief mainly between 60 and 120m; with slopes commonly 8 to 15%.
3	**LOW HILLS**	Predominantly low hills with local relief mainly between 180 and 240m. Slopes are commonly 15 to 30%.

NOTE: Number refers to entry in table.

NOTE: The military reservation boundary shown on this map does not reflect changes that occurred in 1977.

SURFACE DRAINAGE

BANK TO BANK GAP WIDTH

>25m

<3m

3(10) / 30° — Bank height/slope, in m(ft)/degrees

1(3)	1(3)	2(6)	3(9)	Depth low | Normal | Bankfull | High, estimated in m(ft)
3(9)	3(9)	6(20)	10(33)	Width low | Normal | Bankfull | High

Earth dam

W1 Reservoir

G1 Gauging station

F1 Ford

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

C. WATER RESOURCES

1. SURFACE WATER

Three major rivers, Salinas, San Antonio, and Nacimiento, drain Camp Roberts and provide the surface water resources for the area. These river systems generally have low water most of the season; April thru December. Wet months are from January to April and during this period flash flooding is rare. Much of the surface water in the basin of the Salinas River region percolates through the surface material and enters the underground aquifiers.

SOURCE	QUANTITY	QUALITY	ACCESS AND DEVELOPMENT
The Salinas River flows in a northwesterly direction in the low plains region (flood plains) of Camp Roberts for approximately 12 km (7.2 mi). Flood plains range from 200 m (650 ft) to 1.5 km (0.9 mi) in width. The Salinas River enters Camp Roberts on its eastern side and flows directly through the Main Garrison and the East Garrison along the Southern Pacific Railroad. The northern portion of the river borders Camp Roberts' northern boundary for approximately 4 km (2.4 mi) and is 4 to 5 km (2.4 to 3 mi) away from any populated area.	The Salinas River at Paso Robles, California, affords more than 400,000 liters per minute (1.52×10^8 gpd) during wet months, Jan to Apr. During dry months, it affords less than 17,000 liters per minute (6,468,000 gpd). Paso Robles is approximately 25 km (15 mi) upstream from Camp Roberts. However, this location is probably the best source of available data for stream flow in the Salinas River at Camp Roberts. the Salinas River flows through Camp Roberts and both the San Antonio and Nacimiento Rivers flow into the Salinas within Camp Roberts' boundaries.	Natural surface waters are good but may be degraded by municipal waste from the small towns located upstream. Natural stream waters are hard and generally high in total dissolved solids. Suspended sediment load varies with season; and is highest during the wet months from Jan to Apr.	Camp Roberts East and Main Garrisons are situated on the river terrace of the east and west banks of the Salinas River. The river's flood plains divide Camp Roberts' Garrisons and are gently sloped throughout the camp. Access to the Salinas River is excellent. Depths are less than 1 m (3.3 ft).
The San Antonio River flows in a northeasterly direction along the northwestern boundary of Camp Roberts for approximately 5 km (3 mi). It empties into the Salinas River in the Camp's extreme northwestern corner. The San Antonio River is located in a low plains region and exhibits flood plains ranging from 0.5 to 1 km (0.3 to 0.6 mi) wide. This portion of the river is approximately 5.5 km (3.5 mi) west of Camp Roberts' East Garrison.	The San Antonio River is a perennial stream controlled by the San Antonio Reservoir located approximately 5 km (3.0 mi) due west of Camp Roberts' western boundary. Statistics for the rate of discharge are not available. However, the drainage areas of the San Antonio and Nacimiento Rivers are comparable and a general comparison can be drawn.	Natural surface waters are good due to the absence of municipal waste. Natural stream waters are hard and generally high in total dissolved solids. Suspended sediment load varies with season; it is highest during the wet months from Jan to Apr.	Access to the San Antonio River is generally excellent by virtue of its location. Bank heights are less than 1 m (3.3 ft) and slopes are gradual. Several trails and roads on the flood plains and along the banks provide easy access for fording. Water depths are less than 1 m (3.3 ft).
The Nacimiento River traverses Camp Roberts from west to east for approximately 12 km (7.2 mi). It flows in a northeasterly direction from the western low hills to the central and eastern low plains region. The flood plains range in width from 0.5 km (0.3 mi) in the central low plains region to 100 m (300 ft) in the extreme western low hills region. The Nacimiento River empties into the Salinas River at the Camp Roberts' East Garrison area.	The discharge rate of the Nacimiento River at Camp Roberts is controlled by the Nacimiento Reservoir located 2.5 km (1.5 mi) due west of Camp Roberts. The river affords more than 569,000 liters per minute (2.16×10^8 gpd) Feb thru Sep and more than 254,800 liters per minute (9.69×10^7 gpd) Oct thru Jan.	Natural surface waters are good due to the absence of municipal waste. Natural stream waters are hard and generally high in total dissolved solids; suspended sediment load varies with season.	Access to the Nacimiento River is excellent in the central and eastern two-thirds low plains region. Roads and trails are generally less than 1 km (0.6 mi) apart and each side of the river has a road that runs the entire length of the river through the low hills region. Bank heights are less than 0.5 m (1.6 ft) and slopes are predominantly less than 3%. Access to the western third of the river is fair. The southern and northwestern slopes are between 30 and 45% with bank heights greater than 1 m (3.3 ft). However, roads and trails make this portion of the river fairly accessible. Depths are less than 1 m (3.3 ft) throughout.
Tributaries in the southern half of Camp Roberts flow north as they drain the high plains and low hills region and empty into the Nacimiento River. These drainage ways generally occur every 0.5 km (0.3 mi) and range in length from 0.7 to 10 km (0.4 to 6 mi). Tributaries in the northwestern portion of Camp Roberts drain a high plains region and flow primarily in a northwesterly direction as they empty into the San Antonio River. These tributaries are characteristically the same as those in the south. Tributaries in the northeastern portion of Camp Roberts drain a high plains region, and flow in a southwesterly direction and empty into the Salinas River. These tributaries are characteristically the same as those mentioned throughout the Camp.	Seasonal tributary streams carry water during heavy rains and for several hours thereafter.	Tributary stream water is generally hard with high total dissolved solids. Suspended sediment content is high during periods of high water.	Access to the tributaries of Camp Roberts is good. A network of trails and roads generally 1 km (0.6 mi) apart makes this area fordable. Slopes in the high plains and low hills are generally less than 30%. Stream channels are generally dry and less than 3 m (10 ft) wide. Bank heights are less than 1 m (3.3 ft).

ANALYSES OF SURFACE WATERS, CAMP ROBERTS+

Map Unit	Stream Name and Date	ph (Units)	Bicarbonate HCO_3 MG/L	Hardness Ca, Mg MG/L	Non Carbonate Hardness MG/L	Dissolved Calcium (Ca) MG/L	Dissolved Magnesium (Mg) MG/L	Dissolved Sodium (Na) MG/L	Dissolved Potassium (K) MG/L	Dissolved Chloride (Cl) MG/L	Dissolved Sulfate (SO_4) MG/L	Dissolved Silica (SiO_2) MG/L	Dissolved Nitrate (NO_3) MG/L	Dissolved Fluoride (F) MG/L	Carbonate CO_3 MG/L	Dissolved Solids Tons/Ac-Ft	Dissolved Boron (B) UG/L
G-1	*Nacimiento River	Avg 8.3	141.7	142	23	28.5	14.5	9.7	1.2	6.2	33	11	.7	--	1.7	172.5	33
	Water Year Oct 1965 to Sep 1966 Range	8.0 - 8.4	125 - 168	125 - 162	21 - 24	27 - 30	14 - 15	9.4 - 10	1.1 - 1.3	5.3 - 7.0	33	10 - 12	.5 - .9	--	0 - 4	172 - 173	0 - 100
G-2	**Salinas River	Avg--	--	--	--	--	--	--	--	--	--	--	0.12	--	--	--	--
	Water Year Oct 1974 to Sep 1975 Range			--	--	--	--	--	--	--	--	--	0.06 - 0.18	--	--	--	--

Map Unit	Stream Name and Date	Specific Conductance (Micro-Mhos)	Total Phosphorus (P) MG/L	Total Arsenic (As) MG/L	Total Cadmium (Cd) MG/L	Total Chromium (Cr) MG/L	Total Cobalt (Co) MG/L	Total Copper (Cu) MG/L	Total Lead (Pb) UG/L	Total Mercury (Hg) UG/L	Total Zinc (Zn) UG/L	Pesticides++ UG/L	Fecal Coliform Col/100ML	Fecal Streptococci Col/100ML	Temperature C°
G-1	Nacimiento River	Avg 311.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	Water Year Oct 1965 to Sep 1966 Range	281 - 353	--	--	--	--	--	--	--	--	--	--	--	--	--
G-2	Salinas River	Avg 392	0.11	1.25	<10	0	<50	--	<100	0.12	23.5	0	--	--	17.2
	Water Year Oct 1974 to Sep 1975 Range	220 - 627	.06 - .18	0-3	<10-10	0	<50-50	<10-680	<100-100	.0 - .4	4 -60	0	--	--	11 - 21

\+ Complete data are not available for location on Camp Roberts. The data presented represents sources closest to the post. Care must be exercised in evaluating these data because of the incomplete nature of the data and the fact that Camp Roberts is situated between the two measurement sites.

++ Pesticide measurements spotty; where taken, they were all '0'.

* Below Nacimiento Dam, 3.5 km (2.2 mi) downstream from the dam, immediately inside the west boundary of Camp Roberts.

** Salinas River station located 11.5 km (7.1 mi) downstream from Bradley, which is at the northwest boundary of Camp Roberts.

NOTE: MG/L is milligrams per liter; UG/L is micrograms per liter.

C. WATER RESOURCES

2. GROUND WATER

Ground water is the sole source of water at Camp Roberts.

Camp Roberts is on the western margin of the Paso Robles Ground Water Basin. The basin contains up to 305 meters (1000 feet) of folded and faulted continental sand, gravel, silt, clay, freshwater limestone, and tuff. All water is derived from the Paso Robles Formation. Potential sources of water are older alluvial terraces, recent valley alluvium along the Salinas and Nacimiento Rivers, and areas of very small potential in weathered or fractured sedimentary and igneous rocks. None of these sources is utilized because the water available is of limited quantity, seasonally variable, poor quality, and susceptible to contamination.

Four of 14 wells provide most of the water consumed. The remaining wells can provide several times the required amount of water, but mechanical problems, radioactive sand, sulfur, and seasonal variation make these wells virtually unproductive. Peak demand of 3,217,250 liters (850,000 gallons) per day is in the summer months and wells must be pumped daily to satisfy this demand. Seasonally, yield can be increased to approximately 4,731,250 liters (1,250,000 gallons). Water is stored in two aboveground tanks with a total capacity of 4,542,000 liters (1,200,000 gallons).

Water quality in general is good but varies from well to well. Water quality problems include one well with radioactive sand, wells with slightly high sulfur content, one well with high boron content, and one well with high sodium content. Several wells exceed slightly the allowable limits of total dissolved solids. Chlorination is the only water treatment used.

There are plans to add three wells at Camp Roberts—one for the East Garrison and two for Range 18. The wells in the Range 18 area will be at no cost to the government and will be used primarily by the ranchers leasing that land to pasture cattle. Existing wells could yield additional water if wells were swabbed and/or reconditioned and pumps and other equipment replaced or repaired.

Geologically there are good potential sites for additional wells which should produce large amounts of water. A syncline trending southeast across the reservation appears to be the best potential source. Wells would be in the range of 122 to 305 m (400 to 1000 feet) deep as are existing wells. There appear to be no problems in siting new wells.

Standard drilling and testing techniques should be employed with special techniques to prevent pumping large quantities of fine sand. Sand is a problem in some existing wells, causing damage to well equipment and chlorinators. There are no plans to develop ground water resources by either of the above methods.

The four known springs of significance at Camp Roberts vary in quality and are utilized only for watering animals and fire-fighting.

MAP UNIT	QUANTITY AND SOURCE	DEPTH	QUALITY	DEVELOPMENT OF SOURCES
1	Large* quantities of good water from thick continental sedimentary deposits. Potential yield from this unit is very large. Yield varies throughout the basin and is influenced primarily by geologic faults and folds. The average potential yield from 13 wells at Camp Roberts is approximately 568,000 liters (150,000 gallons) per 7½-hour day. Total production capacity from wells currently used is 3.2 - 3.8 million liters (850,000 - 1,000,000 gallons). Consumption during the summer months equals production capacity but drops to 568,000 - 757,000 liters (150,000-200,000 gallons) per day throughout the remainder of the year. Safe drawdown can be evaluated only after overdraft and there has been no indication of overdraft in this basin. Drawdown in one well pumped 8 hours at 5678 liters (1500 gallons) per minute was only 5 m (17 ft) in a deep well. Rebound rate is relatively rapid. There is hydraulic continuity between some adjacent wells but faults and other structures influence continuity, quantity, and quality of water. A synclinal structure at Camp Roberts is a source of large quantities while wells near the Paso Robles Fault produce only moderate quantities and are not as rapidly recharged. Wells in this unit derive their water from the thick lower Pleistocene Paso Robles Formation. Stratigraphically this formation varies widely as evidenced by well logs (see log of well 11, below). Wells are perforated at numerous intervals of sand and gravel to obtain water. Aquifers consist of material from large gravel to very fine sand with porosity and permeability varying with the type of material and degree of sorting. Two springs provide water for cattle.	Wells range in depth from 122 to 305 m (400 to 1000 ft). Lines of equal elevation of ground water are shown below. The Paso Robles Formation thins to the west near the margin of the basin, which terminates in the vicinity of the Paso Robles fault. Depth to water in wells is 8-46 m (26-151 ft). Water is derived from numerous aquifers at varying depths throughout the Paso Robles Formation down to non-water-bearing Pliocene marine and continental sandstone, conglomerate, and shale. New wells should be in the same depth ranges as existing wells to derive maximum production.	Water from the wells currently used is good; however, water from some of the other wells is slightly high in sulfur, chloride, iron, fluoride, manganese, and, in one well now shut down, radioactive material. Water is slightly alkaline, pH 7.2 - 7.9. Table below shows water quality and indicates where water exceeds allowable concentrations. Well 10 (W6) is no longer pumped, due to high radioactivity, although the radioactivity did not exceed allowable amounts. No biological contamination. Present water treatment consists of chlorination at individual wells and water softening at the hospital.	Several locations appear to be good sites for the development of ground water with additional wells. Within the Paso Robles Ground Water Basin the area east of the Salinas River has produced large quantities of water. A syncline cuts the west-central part of Camp Roberts in a southeast- to- northwest direction and should be a source of large quantities of water. Wells would be drilled and would employ common completion and testing techniques.
2	Moderate to small quantities available from varying thickness of older alluvial terrace deposits. Potential yield varies with the areal extent, thickness of the terrace, and the quantity and source of recharge. There are no wells at Camp Roberts which produce from this unit; however, some deeper wells may derive part of their water from these deposits. Outside Camp Roberts, wells for individual dwellings produce adequate quantities. Data on yields, drawdown, and production are not available. Terraces are composed of Pleistocene alluvial marine and continental sand, gravel, and clay; very permeable, with a mixture of grain sizes from clay to cobble. Water table position varies with the thickness of the alluvium, structural control, and water sources.	Thickness ranges from 1 m (3 ft) to 65 m (200 ft). Depth to water will vary with thickness of terrace, topographic position, and relationship to source of recharge. Normal water tables range from 3 m (10 ft) to approximately 12 m (40 ft) below the surface. Well depth for maximum production will be equivalent to the thickness of the terrace. Most wells at Camp Roberts are drilled through this unit into Unit 1 and may derive some water from Unit 1.	Most ground water is generally of good quality. Wells can be slightly high in fluoride, iron, and manganese, and slightly alkaline with pH 7.2 - 7.9. Chemicals in water are derived from alluvial materials. No biological contamination; however, with water near the surface there is a potential for contamination. Water should be chlorinated, and if hard may require softening.	Not a potential source of water in quantities which would be significant in terms of consumption at Camp Roberts.
3	Moderate to meager quantities available from relatively thin recent alluvium. Well yields range from a few liters per minute to 379 liters (100 gallons) per minute. Yield varies with thickness and extent of alluvium and the amount of recharge from streams or precipitation. No wells on Camp Roberts produce solely from this unit. Alluvium is an irregular mixture of sand, gravel, and silt; material is unconsolidated, highly porous, and permeable. There are no known springs in this unit.	Penetration of the alluvium through its entire thickness would normally provide maximum yields; however, the depth of maximum production will vary due to the differences in composition within the alluvium. The water table in wells adjacent to Camp Roberts is from 3 m (10 ft) to 15 m (49 ft) below the surface. Alluvium in the Salinas River valley is approximately 30 m (100 ft) thick near the center of the valley and thinner at valley margins.	Water derived from the alluvium of the Salinas River valley is generally of poorer quality than water from the Paso Robles Formation. Average conductivity 1100 micromhos/cm. Concentrations of sulfate 220, chloride 95, nitrite 8, boron 0.4 and total dissolved solids 820 mg/1. One alluvial well adjacent to Camp Roberts is high in nitrate with 45 mg/1. Information is not available on biological contamination, but the potential for contamination is large due to the shallowness of the wells.	Although there are numerous areas where this unit would produce water, the small quantities available and the potential for contamination preclude consideration of this unit as a source for Camp Roberts.
4	Essentially a non-water-bearing unit. Meager quantities available locally in fractured or weathered bedrock or small areas of alluvium. Rocks consist of Tertiary Mesozoic, and precretaceous marine and continental sandstone, conglomerate, shale, and igneous rocks. The physical characteristics of the rocks in this unit vary widely. Recharge is from precipitation, which is sparse. Two springs provide water for fire-fighting and animals.	There are no wells in this unit. New wells will be shallow.	Quality will vary with the rock type. One of the two springs in this unit is extremely high in sulphur, indicating that wells in some of the sedimentary rocks may be of poor quality.	Not recommended as a source of water. The small quantity, potential for poor quality, and relief in the unit make this material a poor prospect for significant amounts of good water.

*Definitions of underlined terms are as follows:

	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Very large	4,000 - 40,000	1,500,000 - 15,000,000
Large	400 - 4,000	150,000 - 1,500,000
Moderate	40 - 400	15,000 - 150,000
Small	4 - 40	1,500 - 15,000
Meager	Less than 4	Less than 1,500

USER NOTE: For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM5-700, July 1967, Paragraph 19, or other applicable manuals or regulations.

PRODUCTION WELL DATA, 1977

WELL NUMBER*	LOCATION GRID REFERENCE	DEPTH meters	DEPTH (feet)	MAXIMUM DAILY CAPACITY liters (000)	MAXIMUM DAILY CAPACITY gallons (000)	AVERAGE DAILY PRODUCTION liters (000)	AVERAGE DAILY PRODUCTION gallons (000)	REMARKS
1 (B2)	041649	183	600	1136	300	1136	300	Slightly high in sulfur
2 (C1)	026643	152	500	1476	390	no data		Mechanical problems
3 (C3)	015634	103	338	852	225	852	225	
4 (C4)	013638	98	320	852	225	no data		High sulfur, sand
5 (WC5)	011632	186	610	1325	350	1325	350	
6 (W6A)	026661	62	204	170	45	no data		Limited use-redwood tank
7 (W1)	051628	297	975	1684	445	no data		Pumps air
8 (W3)	025648	194	636	1628	430	no data		
9 (5A)	039643	187	612	1136	300	no data		Mechanical problems
10 (W6)	027645	217	712	2460	650	no data		Radioactive sand-closed
11 (W11)	023645	132	432	1363	360	1363	360	Sand
12 (W12)	019642	158	518	2157	570	no data		Seasonal-high salt
13 (W13)	004626	107	350	606	160	no data		Mechanical problems
14 (W14)	987603	35	115	852	225	no data		7000 gallon tank-on demand only
			TOTALS	17,694	4675	4675	1235	

*Number in parentheses is Camp Roberts designator.

2. GROUND WATER

WATER QUALITY, CAMP ROBERTS, CALIFORNIA

CONSTITUENT	UNIT OF MEASURE*	WELL NUMBER AND DATE OF SAMPLE** 1(B2)	2(C1)	3(C3)	5(WC5)	6(W6A)	8(W3)	9(5A)	10(W6)	11(W11)	12(W12)	14(W14)	Distribution System
		JUL 76	SEP 75	JUL 76	JUL 76	JUL 76	JUL 76	JUL 76	JAN 75	JUL 76	JUL 76	JUL 76	JUL 76
Alkalinity (as CAC03)	mg/1	265.00	280.00	350.00	254.00	274.00	276.00	319.00	288.00	308.00	283.00	156.00	342.00
pH	pH units	8.00	8.30	8.31	8.16	8.05	8.10	8.10	7.90	8.4	8.40	8.20	8.50
Hardness (total as CAC03)	mg/1	300.00	112.00	85.40	158.00	561.00	94.20	297.00	109.00	73.00	69.90	188.00	101.00
Calcium	mg/1	59.80	24.00	17.60	30.30	129.00	21.60	61.20	21.00	16.20	17.40	44.50	22.90
Potassium	mg/1	4.70	5.90	3.40	2.90	6.10	3.60	2.50	2.80	2.90	2.20	1.20	2.30
Silica	mg/1	33.50	14.00	43.60	40.00	34.40	39.80	33.60	47.30	43.80	43.40	6.00	32.40
Specific conductance	umhos	1850.00	1116.00	1145.00	755.00	1650.00	2077.00	1400.00	1510.00	1310.00	960.00	420.00	1480.00
Total dissolved solid	mg/1	1129.00	960.00	674.00	458.00	1389.00	1279.00	865.00	967.00	790.00	964.00	250.00	886.00
Langlier index (corrosive)		0.37775	0.344	0.35378	0.34608	0.73946	0.16552	0.61025	0.116	0.33081	0.36443	0.39718	0.61
Color		5.00	N/A	<5.00	<5.00	5.00	6.00	<5.00	<5.00	<5.00	10.00	<5.00	5.00
Fluorides	mg/1	0.320	0.68	0.320	0.20	0.36	0.380	0.50	0.42	0.37	0.40	0.22	0.40
Iron	mg/1	1.06	0.16	0.091	0.21	2.48	5.72	0.879	9.0	0.193	2.73	<0.06	0.06
Magnesium	mg/1	38.50	13.40	6.90	20.00	61.60	11.40	35.00	11.00	8.00	10.00	17.50	11.30
Manganese	mg/1	0.165	0.026	0.034	<0.02	0.116	0.043	0.209	0.22	<0.02	0.076	<0.02	0.02
Chlorides	mg/1	176.00	110.00	94.70	57.80	91.20	235.00	129.00	159.00	81.60	56.4	7.1	1.34
Sulfates	mg/1	400.00	152.00	91.50	49.50	580.00	535.00	214.00	230.00	230.00	101.00	43.7	174.00
Arsenic	mg/1	<0.010	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Barium	mg/1	<0.300	N/A	0.30	<0.30	<0.30	<0.30	<0.30	N/A	<0.30	<0.30	<0.30	0.30
Boron	mg/1	2.28	2.40	2.16	0.60	1.04	5.72	1.72	2.20	2.24	1.22	0.11	2.66
Cadmium	mg/1	<0.001	0.002	<0.001	<0.001	<0.01	<0.001	<0.001	0.0012	<0.001	<0.001	<0.001	0.001
Chromium	mg/1	<0.010	0.01	<0.02	<0.02	<0.02	<0.01	<0.01	0.05	<0.02	<0.01	<0.01	0.01
Copper	mg/1	0.168	0.33	0.038	<0.02	<0.02	0.213	0.349	1.35	0.059	0.035	<0.02	0.02
Lead	mg/1	<0.010	0.01	<0.01	<0.01	<0.01	<0.01	0.014	0.039	<0.01	<0.01	<0.01	0.01
Mercury	mg/1	<0.0004	0.00	<0.0004	0.0069	<0.0004	<0.0004	<0.0004	0.0005	<0.0004	<0.0004	<0.0004	0.00
Nitrate (as nitrogen)	mg/1	0.39	0.10	0.21	3.35	0.11	<0.04	<0.04	1.20	<0.04	4.80	<0.04	0.35
Silver	mg/1	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01
Sodium	mg/1	276.00	298.00	230.00	107.00	203.00	425.00	197.00	300.00	278.00	190.00	13.6	285.00
Zinc	mg/1	0.267	0.02	<0.02	<0.02	<0.02	0.073	0.026	0.310	<0.02	<0.02	<0.02	0.07
Gross Alpha	PC/1	1.10	3.60	4.70	2.20	12.60	2.30	4.5	15.10	9.00	4.00	2.30	3.40
Gross Beta	PC/1	7.00	4.40	4.90	4.40	17.20	9.50	5.60	7.30	8.50	8.50	2.40	4.30
Tritium	micro curie/1	0.0004	0.10	<0.0003	0.0003	0.0003	0.0004	0.0005	0.00092	0.0006	0.0003	0.0003	0.0004

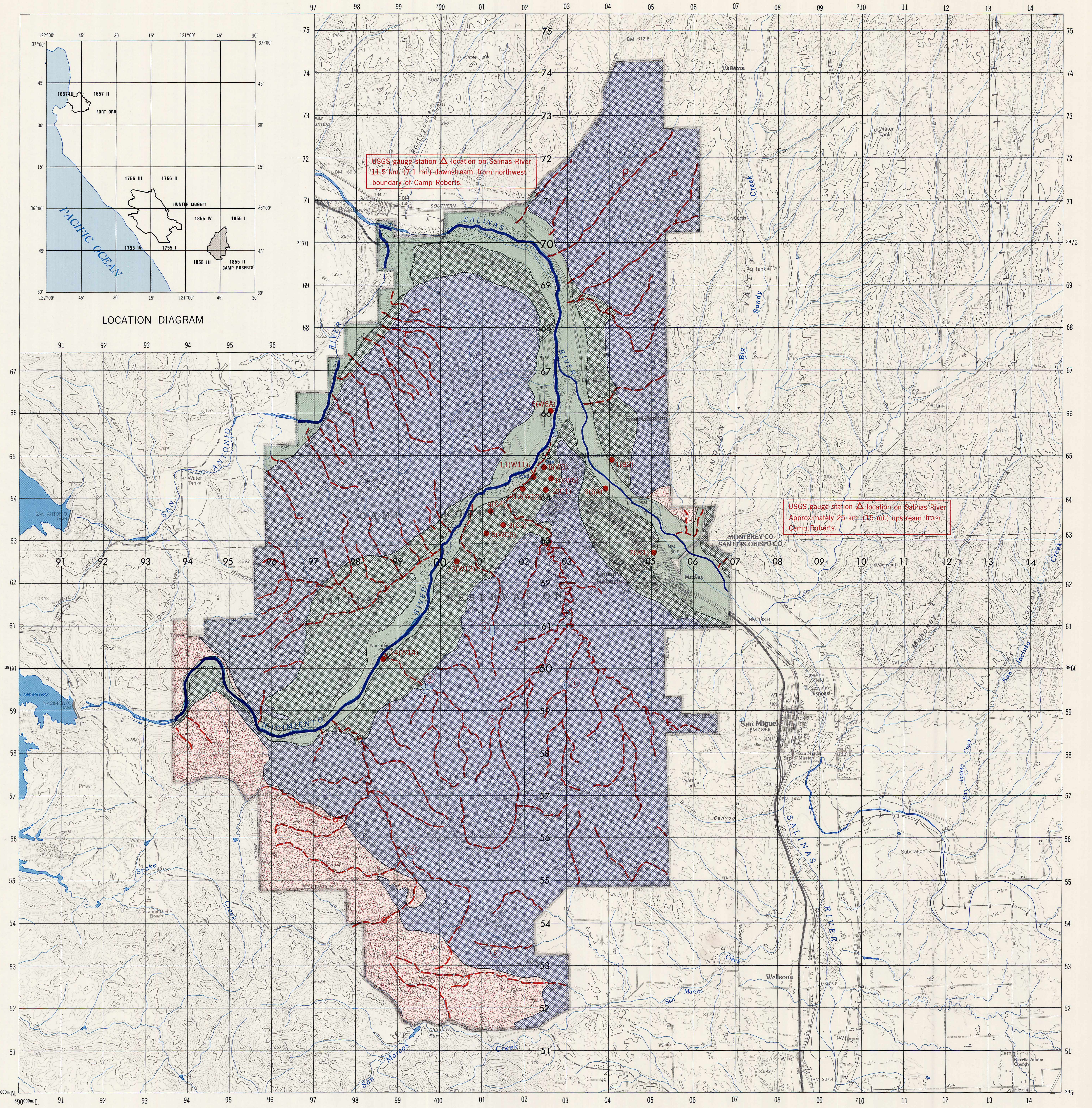
* mg/1 = milligrams per liter; umhos = micromohs; PC/1 = Pico Curies per liter.

** Data not available for wells 4(C4), 7(W1), 3(W13).

N/A = not analyzed.

REPRESENTATIVE DRILLING AND CASING LOG
WELL 11 (W11)

DEPTH meters	DEPTH (feet)	THICKNESS meters	THICKNESS (feet)	DESCRIPTION	CASING
0-8.5	(0-28)	8.5	(28)	Top soil, sand, rock, and clay	Surface
8.5-15.2	(28-50)	6.7	(22)	Yellow clay	40.2 m (132 ft) Blank
15.2-15.8	(50-52)	0.6	(2)	Gravel and yellow clay	6.0 m (20 ft) Perforated
15.8-33.2	(52-109)	17.4	(57)	Yellow sandy clay	46.3 m (152 ft)
33.2-34.7	(109-114)	1.5	(5)	Yellow clay	6.0 m (20 ft) Blank
34.7-36.3	(114-119)	1.5	(5)	Yellow sandy clay	52.4 m (172 ft)
36.3-37.2	(119-122)	0.9	(3)	Gravel	6.0 m (20 ft) Bottom 4.9 m (16 ft) perforated; 1.2 m (4 ft) blank
37.2-40.2	(122-132)	3.1	(10)	Yellow clay	58.5 m (192 ft)
40.2-47.2	(132-155)	7.0	(23)	Gravel, hard at bottom	6.0 m (20 ft) Bottom 2.4 m (8 ft) blank; 3.7 m (12 ft) perforated
47.2-48.5	(155-159)	1.2	(4)	Gravel, very hard	64.6 m (212 ft)
48.5-50.0	(159-164)	1.5	(5)	Yellow clay	6.0 m (20 ft) Blank
50.0-51.8	(164-170)	1.8	(6)	Gravel	70.7 m (232 ft)
51.8-53.6	(170-176)	1.8	(6)	Yellow clay	6.0 m (20 ft) Bottom 1.2 m (4 ft) perforated; (16 ft) blank
53.6-62.2	(176-204)	8.5	(28)	Gravel, some clay streaks: bottom very hard	76.8 m (252 ft) 6.0 m (20 ft) Bottom 3 m (10 ft) blank; 3 m (10 ft) perforated
62.2-64.6	(204-212)	2.4	(8)		82.9 m (272 ft)
64.6-66.1	(212-217)	1.5	(5)	Clay	6.0 m (20 ft) Blank
66.1-75.9	(217-249)	9.8	(32)	Yellow clay, hard	89.0 m (292 ft)
75.9-79.8	(249-262)	4.0	(13)	Gravel	
79.8-80.4	(262-264)	0.6	(2)	Yellow clay	
80.4-83.8	(264-275)	3.4	(11)	Yellow clay	
83.8-91.7	(275-301)	7.9	(26)	Yellow clay	Drillers: E. Burk, J. Mattos and J. Bettencourt (address unknown)
91.7-93.9	(301-308)	2.1	(7)	Gravel and clay	Conductor Pipe: 38.1 m (125 ft) of 76.2 cm (30 in) pipe.
93.9-101.2	(308-332)	7.3	(24)	Yellow clay	Casing: 89 m (292 ft) of 36.6 cm (14 in) pipe.
101.2-101.8	(332-334)	0.6	(2)	Gravel	Taper: 82.3 - 89 m (270 - 292 ft) cemented around casing to prevent
101.8-103.3	(334-339)	1.5	(5)	Clay	salt water instrusion; 61.6 - 131.6 m (202 - 432 ft) cement plug.
103.3-106.7	(339-350)	3.4	(11)	Gravel	
106.7-108.5	(350-356)	1.8	(6)	Gravel and clay	
108.5-112.1	(356-368)	3.7	(12)	Hard yellow clay	
112.1-112.7	(368-370)	0.6	(2)	Blue clay	
112.7-115.5	(370-379)	2.7	(9)	Blue clay and gravel	
115.5-117.6	(379-386)	0.9	(3)	Gravel	
117.6-120.7	(386-396)	4.3	(14)	Clay	
120.7-129.8	(396-426)	9.1	(30)	Gravel: some clay streaks	
129.8-131.6	(426-432)	1.8	(6)	Clay, hard and yellow	



CAMP ROBERTS, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

SURFACE WATER

FRESH WATER PERENNIALLY PLENTIFUL

1. Enormous* quantities available all year from Nacimiento and San Antonio Rivers.
2. Very large quantities available all year from Salinas River , increasing to enormous quantities during January to April.

FRESH WATER SCARCE

3. Small to meager quantities may be available during dry season (May to November) from the small tributary streams, although they are frequently dry. During wet season, there may be a continuous small trickle. These stream beds are generally spaced less than 0.5 km apart.

△ U.S. Geological Survey Gauge Station

① Flood Check Dam

Dam No.	Grid Coordinates	Pond Length m(ft)	Area Ha (A)
1	030597	137(450)	3.6(9)
2	014588	126(412)	2.8(7)
3	013610	157(515)	7.7(19)
4	997596	91(300)	3.6(9)
5	014534	48(158)	0.3(0.8)
6	963613	73(238)	1.2(2.9)
7	993556	61(200)	1.5(3.6)

*Definitions of underlined terms are as follows:

	Liters Per Minute (LPM)	Gallons Per Day (GPD)
Enormous	>40,000	>15,000,000
Very large	4,000—40,000	1,500,000—15,000,000
Large	400—4,000	150,000—1,500,000
Moderate	40—400	15,000—150,000
Small	4—40	1,500—15,000
Meager	<4	<1,500

USERS NOTE: For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM 5-700, July 1967, paragraph 19,or other applicable manuals or regulations.

NOTE: The military reservation boundary shown on this map does not reflect changes that occurred in 1977.

WATER RESOURCES

GROUND WATER

FRESH WATER GENERALLY PLENTIFUL

1. Large* to moderate quantities available from thick continental sand, gravel and clay. (Material under map units 2 and 3.)

FRESH WATER LOCALLY PLENTIFUL

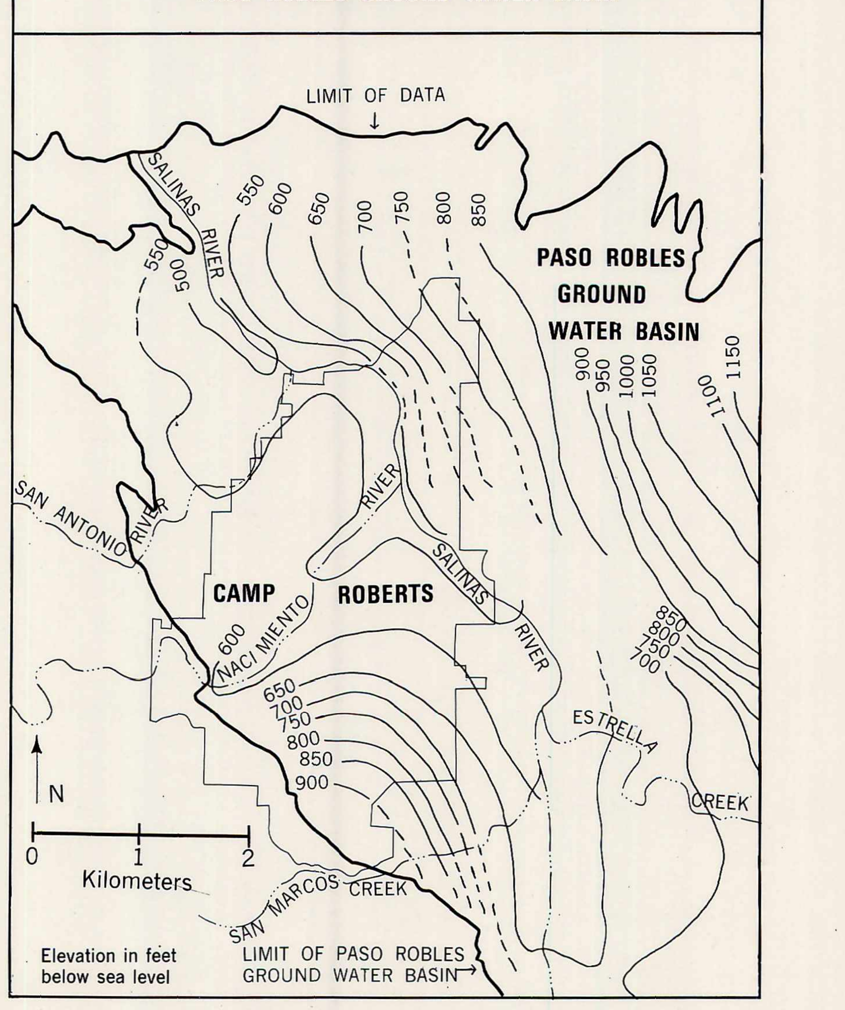
2. Moderate to small quantities available from thin terrace deposits and older marine and continental sand, gravel and clay.
3. Moderate to meager quantities available from thin deposits of recent alluvial sand, gravel and clay.
4. Meager quantities available in a few isolated fracture zones in bedrock or in pockets of alluvium.

NOTE: Number refers to entry in table.

● 1(B2) Well (number in parentheses is Camp Roberts designator)

♀ Spring (no data available)

LINES OF EQUAL ELEVATION OF GROUND WATER
PASO ROBLES GROUND WATER BASIN



Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

D. ENGINEERING SOILS

SOIL CHARACTERISTICS AND SELECTED EVALUATIONS

Generalized engineering soils data shown on the map and in the table, have been adapted from small-scale county soil association maps and from a more detailed soil survey report of Monterey County, California. Information presented here is generalized but should be helpful in general planning for land use or construction activities. For information on a specific site or otherwise small area, an on-site field survey and testing is required.

Soils on Camp Roberts are predominately of two types, loams and sands. The loams are formed in place from underlying soft shales and mudstones. Sandy soils are a product of weathering and water sorting of older alluvial deposits. Soil depths vary from nil in the Rocky Lands, Map Unit 5, to many meters thick in the older alluvial deposits, Map Units 1 and 2.

Due to weather conditions of the area, most of the soils are unaffected by a seasonal high water table. The only parts of the Camp affected are the large streams and low-lying areas along these streams. Rains capable of producing flooding occur during the time period of November to March.

Soils on the Camp are predominately alkaline, but range from medium acid (ph 5.6) to moderately alkaline (ph 8.4). Natural fertility of the soil varies from low to high with high fertility soils composing over 50 percent of the total. Organic matter is low, which is typical for the area. Approximately 80 percent of the Camp has soils that would support the cultivation of grain or that are suitable for pastureland.

Generally, soils of Map Units 1 and 4 are best suited for construction and engineering purposes and soils of Map Units 2 and 5 are the least suited.

Typical soil profile diagrams are shown for each map unit. These diagrams depict the representative composition and sequence of layers of the dominant soils within the map unit. Estimated thickness of layers is indicated in centimeters.

For more comprehensive information concerning kinds, distribution and properties of Camp Roberts soils, the user of this terrain study should seek the assistance of the Soil Conservation Service, U.S. Department of Agriculture, Santa Maria or Paso Robles, California.

							RATING AND MAJOR KINDS OF LIMITATIONS FOR:							
MAP UNIT	MAJOR SOIL SERIES 1/	GEOGRAPHIC SETTING	TYPICAL SOIL PROFILE — layers, thickness and color of layers, depth to rock and Unified engineering classification 2/ (Profile diagram not to scale).	HIGH-WATER TABLE- depth (meters) and duration (months)	PERMEABILITY- centimeters/hour or (inches/hour)	SHRINK-SWELL POTENTIAL	SEWAGE LAGOONS	SEPTIC TANK FILTER FIELDS	FOUNDATIONS FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATIONS	TRAFFIC-ABILITY	BIVOUAC SITES	REMARKS
1	Chualar Perkins Tierra	Nearly level to moderately sloping terraces and low hills. Slopes range up to 15 percent with most slopes 2–9 percent. Soils developed from old alluvial deposits.	cm SM — Grayish-brown sandy loam. 50 CL — Reddish-brown sandy clay loam. 100 var ious — Loosely consolidated old alluvial deposits. 180+	Low areas near streams subject to flooding after rains (Nov to Mar).	1.5–5.0 cm/hr (0.6–2.0 in/hr) 0.5–1.5 cm/hr (0.2–0.6 in/hr 1.5–5.0 cm/hr (0.6–2.0 in/hr)	Low to Moderate	Severe (s)	Severe (s)	Moderate (a)	Slight	Slight	Slight	Slight	Occurs along stream valleys. Best soil for overall engineering use. Map unit covers about 46 km^2 (11,350 acres).
2	—	Soils that occur in active stream channels and rivers; 0–3 percent slope.	cm SM SP GP — Water-deposited sandy, gravelly, cobbly and stony sediments commonly stratified. 180+	Subject to flooding after rains (Nov to Mar).	Greater than 15.0 cm/hr (Greater than 6.0 in/hr)	Low	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Soils in this unit are undesirable for construction sites, but are good source for sand and gravel. Map unit covers about 27 km^2 (6,671 acres).
3	Nacimiento Linne	Smooth, rolling to moderately steep hills. Slopes range from 9–30 percent with a few areas as high as 50 percent. Soils developed in place from soft shales and mudstones.	cm CL — Dark grayish-brown silty clay loam. 79 Bed-rock — Weathered calcareous shale. 180+	None	0.5–1.5 cm/hr (0.2–0.6 in/hr)	Moderate	Severe (h)	Moderate (h)	Moderate (h)	Moderate (h) (a) (t)	Moderate (h)	Moderate (h) (t)	Slight	Soils in this unit are stable under good vegetation cover but are moderately erodible when over-grazed or disturbed. Suitable for pasture, and dry farming. Map unit covers about 87 km^2 (21,571 acres).
4	Kettleman	Moderately steep to steep hills and mountains. Slopes range from 15–50 percent.	cm SC — Pale brown, calcareous, granular loam. 76 Bed-rock — Sandstone, shale or soft stony deposits. 180+	None	Less than 1.6 cm/hr (Less than 0.63 in/hr)	Moderate	Severe (h)	Moderate (h)	Moderate (a)	Severe (h) (r)	Severe (a) (h) (r)	Moderate (h)	Moderate (h)	Most of the map unit area is suitable for rangeland, but production low due to lack of rain. Erosion hazard is high. Map unit covers about 11 km^2 (2,842 acres).
5	Rocky Lands (miscellaneous land type)	Very steep to extremely steep hilly or mountainous areas. Slopes are commonly 60–75 percent. Rock commonly outcrops on 30 percent or more of the area. There is seldom more than 25 cm (10 in) of soil over bedrock.	cm SC — Brown granular loam. 13 Bed-rock — Sandstone, shale or soft stony deposits. 180+	None	Less than 0.15 cm/hr (Less than 0.06 in/hr)	Low	Severe (h) (r)	Severe (h) (r)	Severe (h) (r)	Severe (h) (r)	Severe (h) (r)	Severe (h)	Severe (h)	Soils in this unit are undesirable for construction because of steep slopes and rock outcrops. Areas within this unit are suitable for watershed purposes but require protection from removal of vegetation. Map unit covers about 7 km^2 (1,566 acres).

1/ Soils that have profiles almost alike make up a soil series. The series is the common name of the soil. Each series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Many other minor soils are included in the map unit.

2/ The Unified Soil Classification System, Technical Memorandum No. 3-357, U.S. Army Corps of Engineers, March 1953.

DEFINITIONS OF RATING TERMS

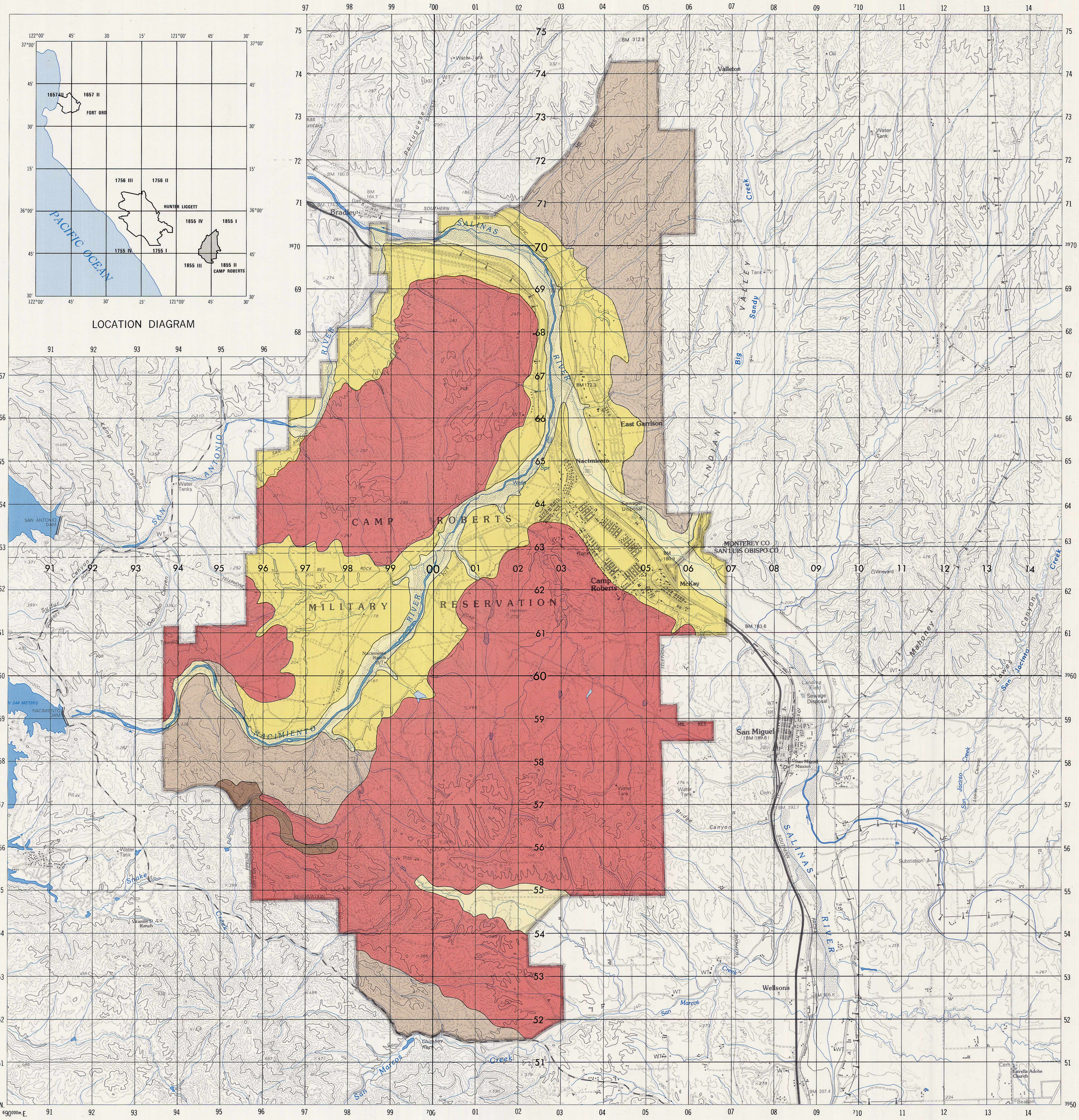
SLIGHT – relatively free of limitations or limitations are easily overcome.

MODERATE – limitations can be overcome with good planning and/or careful design.

SEVERE – limitations are serious and are difficult to overcome.

SOIL RELATED PROPERTIES AFFECTING LIMITATIONS

a – high shrink-swell	r – depth to rock
f – floods	s – seepage, porous soil
h – slope	t – low strength



CAMP ROBERTS, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

ENGINEERING SOILS

COARSE-GRAINED SOILS

1. Sandy loam on moderately sloping terraces and low rolling hills.

2. Alluvium consisting primarily of sand mixed with varying amounts of gravel and cobble; commonly stratified.

FINE-GRAINED SOILS

3. Silty clay loams developed from soft shales and mudstones; occurs on rolling to moderately steep hills.

COARSE- AND FINE-GRAINED SOILS

4. Granular loams developed from sandstone, shale or soft stony and deposits; occurs on steep hills or mountains.
5. Rocky lands; extensive rock outcrops with very thin soil covering.

NOTE: Number refers to entry in table.

NOTE: The military reservation boundary shown on this map does not reflect changes that occured in 1977.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

E. ENGINEERING GEOLOGY

Camp Roberts is in the California Coast Ranges section of the Pacific Border physiographic province. The Salinas River crosses the northeastern part of the reservation, entering just north of San Miguel, in San Luis Obispo County, and exiting at Bradley, in Monterey County. The Nacimiento and San Antonio Rivers to the west, and Big Sandy Creek to the east join the northwesterly flowing Salinas River on the reservation. The valley of the Salinas across the reservation is from 0.3 to 0.6 km (0.5 to 1.0 mi) wide, and at an approximate elevation of 180 m (590 ft). Flanking the valley are hills averaging about 300 m (984 ft) in elevation, but rising to 500 m (1643 ft) elevation at the southwestern boundary of Camp Roberts. The hills are moderately well dissected, except for relatively undissected areas south of the main garrison and bordering the Nacimiento River.

Sand, gravel, sandstone, and conglomerate of Quaternary or late Tertiary age are predominant on Camp Roberts. Older Tertiary mudstones and shales of the Monterey Formation, and sandstones of the Pancho Rico, Santa Margarita, and Tierra Redonda Formations make up the southwestern corner of the reservation.

The load-bearing capabilities of both rocks and unconsolidated materials on Camp Roberts are adequate for the construction of moderate to heavy structures. Level terrain is available in the river valleys, of limited extent on most of the hilly areas, and virtually non-existent in the rugged southwestern corner of the reservation. Road and railroad alinements are easily constructed in the valleys, with some bridges and culverts required; in the hilly areas, alinements are feasible only if they follow nearly constant elevations.

Rocks and unconsolidated materials within the reservation offer vast amounts of potential fill material; valley bottoms can provide large quantities of sand and gravel. Just outside Camp Roberts, to the west, are deposits of diatomite and bituminous rock which may have subsurface extensions onto the reservation near the Nacimiento River.

Camp Roberts is in a region of active faulting and earthquake activity. See Section F. Special Physical Phenomena for further discussion.

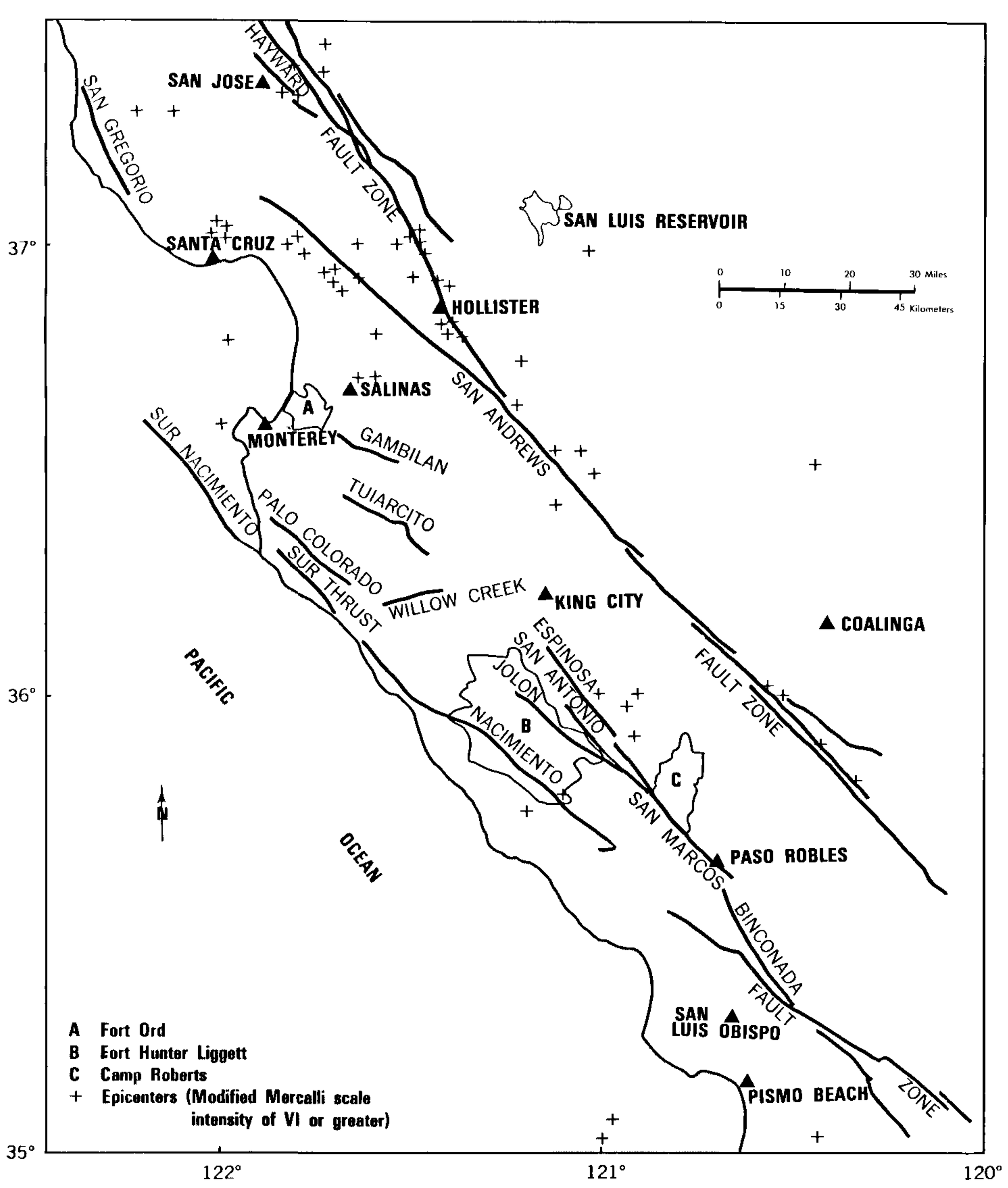
Geological units on the accompanying map were delineated from aerial photo analysis and from U.S. Geological Survey maps. Unit boundaries are not precise.

MAP UNIT		TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATION	EXCAVATION FACTORS	PITS AND QUARRIES
1	Sand and gravel	Floors, flood plains, and terraces of valleys of the Salinas, San Antonio and Nacimiento Rivers, and one small area in the southern part of the reservation near the junction of Perimeter and Generals Roads. Lowest and most nearly level areas on the post; elevations generally from 165 m (540 ft) to about 213 m (700 ft), but to 275 m (900 ft) in the one small area.	Principally semiconsolidated sand and gravel; unconsolidated sand and gravel in stream beds. Thickness of materials over 25 m (85 ft) near Bradley, but varies.	Porosity, permeability, and absorption rates high. Very little to no shrink-swell. Seismic velocity low.	Road alinements easy, but frequent minor water courses require culverts or bridges. Load-bearing capability high; adequate for heavy structures, but stability on steep slopes poor. Drainage good. Abundant sand and gravel available.	Excavation easy with front-loaders or draglines in stream beds, and with power shovels on terraces.	Abundant potential borrow pit sites along San Antonio, Nacimiento, and Salinas Rivers.
2	Conglomerate and sandstone; mudstone common locally	Moderately to highly dissected hillocks which, with the major valleys, occupy all of Camp Roberts except along the southwestern boundary. Elevations of hillocks average about 122 m (400 ft) above floors of major valleys.	Principally alternating conglomerate and sandstone a few feet to scores of feet thick. Mudstone also common; limestone rare; lignite occurs locally. Unit is more than 430 m (1410 ft) thick near Bradley, thinning to the southwest.	Porosity and permeability moderate to high. Low shrink-swell, except high if mudstone present.	Road alinements require cut-and-fill. Load-bearing capability generally high, adequate for moderate to heavy structures. Slope stability fair. Materials suitable for fill; asphalt-impregnated sandstone and conglomerate in lower part of unit, exposed on both sides of San Antonio River just west of the reservation, have been used as road paving.	Excavation easy with power equipment. Support generally required for steeper slopes. Unit accessible from existing roads and tracks.	Numerous quarry sites available near existing roads; construction of new access roads moderately difficult. Asphalt-impregnated rock near San Antonio River quarried in late 19th century.
3	Sandstone; some mudstone and conglomerate.	Limited, discontinuous, northwesterly trending areas adjacent to and near the southwestern boundary of the reservation; well dissected, some very steep slopes. Elevations range from 198 m (650 ft) near the Nacimiento River to more than 488 m (1600 ft).	Primarily fine- to coarse-grained arkosic sandstone, locally conglomeratic. Color olive-gray to yellowish-gray to white. Friable to well cemented. Massive to thin-bedded; thickness of unit from 152 m (500 ft) in northern part to several thousand feet in the southern part.	Porosity 2 – 5%, permeability moderate. Specific gravity 2.5 – 2.6. No shrink-swell. Poissons ratio 0.17. Compressive strength 353 – 1480 kg/sq cm (5000 – 21,000 lb/sq in.).	Limited areas and hilly terrain make unit generally unsuited for construction uses. Load-bearing capability high; slopes stable. Sandstone suitable for fill.	Excavation requires heavy-duty power equipment, some light blasting. Sandstone stable on steep slopes.	No existing quarries. Best potential sites where unit crosses the Nacimiento River, and along southern edge of reservation at San Marcos Creek.
4	Shale and mudstone	Northwesterly trending belt of highly dissected hills in the southwestern part of the reservation, extending from the Nacimiento River to the southernmost boundary.	Entirely within the Monterey Formation, a mixture of porcelaneous and calcareous shale and mudstone, chert, and dolomitic carbonate rock; uppermost member contains some diatomaceous mudstone. Unit is several thousand feet thick. Weathering may be quite deep.	Porosity and permeability low. Shrink-swell often high.	Hilly terrain makes unit generally unsuitable for construction uses. Road alinements require cut-and-fill, or maintenance of grades along nearly constant elevations. Load-bearing capability ranges from poor to good. Shrink-swell, and slipping along bedding planes potential problems; rock slides a possible hazard.	Excavation feasible with normal power equipment. Support necessary for steep slopes or in tunnels.	No existing quarries. Best potential quarry sites at northern and southern ends of unit.

F. SPECIAL PHYSICAL PHENOMENA

Camp Roberts is bracketed by an active portion of the San Andreas Fault system to the east, and by a highly faulted area immediately to the west which includes major faults such as the Jolon, San Antonio, Bee Rock, San Marcos (Paso Robles), and Nacimiento. Minor earthquakes have been frequent in this area. The reservation is in Zone 3 (possible major damage) of the Seismic Risk Zone map of the U.S. Geological Survey. It is in a seismically active region, and all engineering efforts must recognize special design requirements.

MAJOR FAULTS AND APPROXIMATE EPICENTERS OF EARTHQUAKES OF CENTRAL COASTAL CALIFORNIA THROUGH 1970

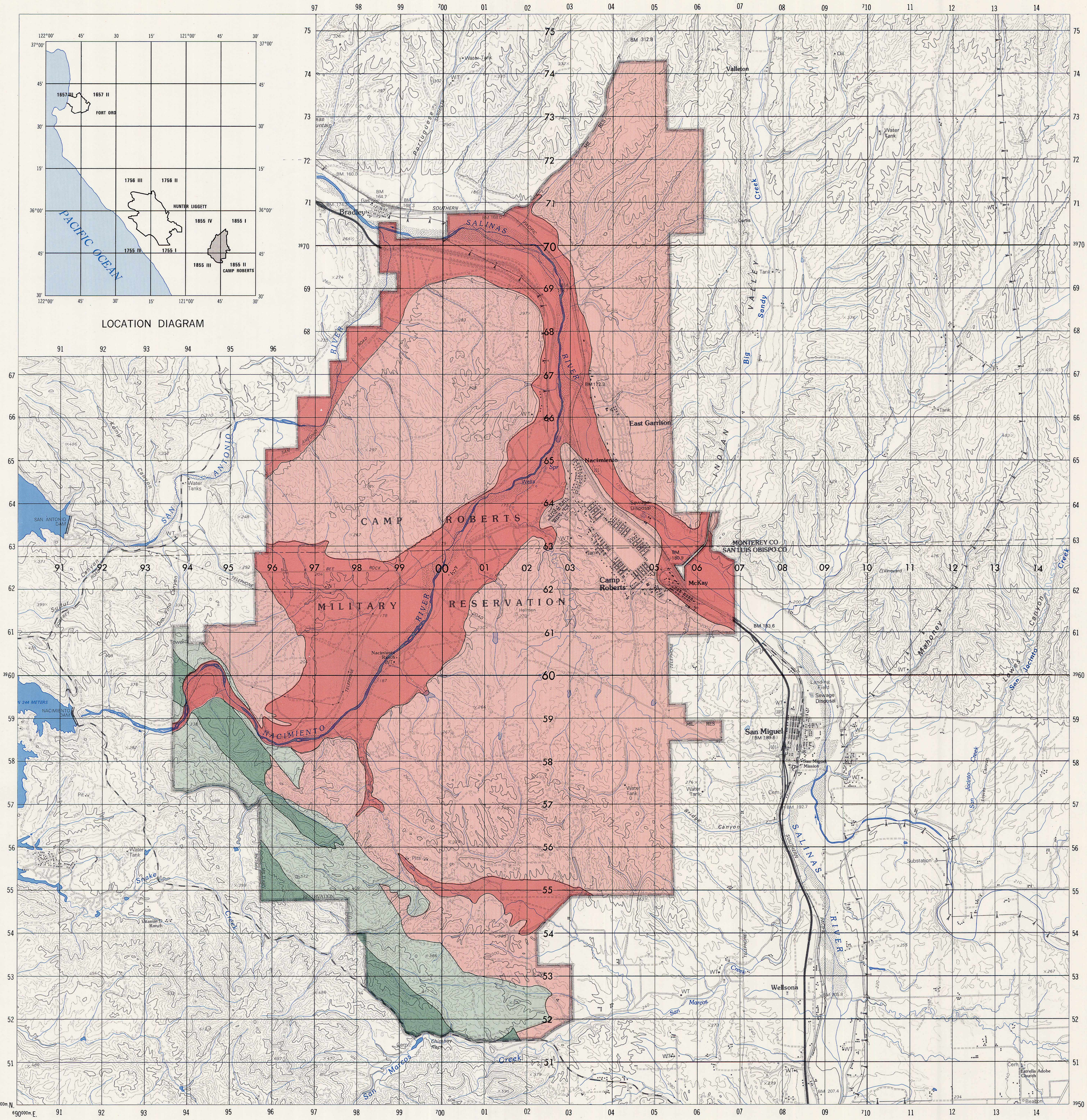


MAJOR FAULTS AND APPROXIMATE EPICENTERS
OF EARTHQUAKES OF CENTRAL COASTAL
CALIFORNIA THROUGH 1970
(Intensity of VI or Greater on Modified Mercalli Scale*)

YEAR	DATE	N. LAT	W. LONG	INTENSITY
1970	Jan. 2	37°18′	122°6′	VI
1969	Oct. 27	36°48′	121°24′	VI
1967	Dec. 18	37°0′	121°48′	VI
	Sept. 28	37°12′	121°36′	VI
	Sept. 7	37°0′	121°48′	VI
	July 22	36°30′	121°6′	VI
1966	Oct. 14	37°0′	121°48′	VI
	June 27	35°54′	120°54′	VII
1963	Sept. 14	36°48′	121°36′	VII
	May 22	37°18′	122°12′	VI
1961	Apr. 8	36°42′	121°18′	VII
1960	Jan. 19	36°48′	121°24′	VI
1959	Dec. 28	36°54′	121°30′	VI
	May 26	36°42′	121°36′	VI
	Mar. 2	37°0′	121°36′	VI
1958	Sept. 30	36°24′	121°6′	VI
1956	Nov. 15	36°0′	120°30′	VI
1955	Nov. 2	36°0′	120°54′	VI
	Sept. 4	37°54′	121°48′	VII
	Mar. 2	36°0′	120°54′	VI
1954	Sept. 15	37°18′	120°0′	VI
	Aug. 12	36°54′	121°42′	VI
	Aug. 22	36°54′	121°42′	VIII
	Mar. 19	36°54′	121°42′	VI
1953	Dec. 16	36°54′	121°42′	VI
1952	Nov. 21	35°48′	121°12′	VII
1951	Oct. 31	36°54′	121°24′	VI
	Aug. 6	36°36′	121°12′	VI
	July 29	36°36′	121°12′	VI

YEAR	DATE	N. LAT	W. LONG	INTENSITY
1949	June 9	37°24′	121°36′	VI
	Mar. 9	37°0′	121°30′	VII
1948	Dec. 31	36°54′	121°36′	VII
1947	Aug. 10	36°54′	121°24′	VI
	June 22	37°0′	121°48′	VI
1945	Aug. 27	37°18′	121°48′	VI
	May 17	36°48′	121°24′	VI
	Jan. 7	36°42′	121°12′	VI
1943	Oct. 25	37°24′	121°42′	VI
1939	June 24	36°48′	121°24′	VII
1934	June 7	36°0′	120°30′	VIII
1927	Nov. 18	35°0′	120°30′	VI
	May 28	37°18′	121°48′	VI
	Feb. 15	37°0′	122°0′	VI
1926	Oct. 22	36°45′	122°0′	VIII
	July 25	36°30′	120°30′	VI
1924	Dec. 27	36°42′	121°36′	VI
1922	Mar. 10	35°45′	120°15′	IX
1916	Dec. 1	35°0′	121°0′	VII
	Aug. 6	36°30′	121°0′	VII
1914	Nov. 8	37°0′	122°0′	VII
1911	July 1	37°0′	122°0′	VII – VIII
	Mar. 11	37°0′	121°0′	VI
1901	Mar. 2	36°0′	120°30′	VII – VIII
1899	Apr. 30	37°0′	121°30′	VII
1897	June 20	37°0′	121°30′	VIII
1892	Nov. 13	36°30′	122°0′	VI
1890	Apr. 24	37°0′	121°30′	VII
1885	Apr. 11	36°0′	121°0′	VII – VIII
	Mar. 30	36°30′	121°0′	VII
1883	Mar. 30	37°0′	122°0′	VI
1865	Oct. 8	37°0′	122°0′	VIII – IX
1852	Dec. 17	35°0′	121°0′	VII – VIII

*Note: Intensity of VI indicates lowest level of damage.
Intensity of IV indicates collapse of some structures.



CAMP ROBERTS, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

ENGINEERING GEOLOGY

MANY ENGINEERING USES

1. Sand and gravel
2. Conglomerate and sandstone; mudstone common locally

FEW ENGINEERING USES TO UNSUITED

3. Sandstone; some mudstone and conglomerate
4. Shale and mudstone

NOTE: Number refers to entry in table.

NOTE: The military reservation boundary shown on this map does not reflect changes that occurred in 1977.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

G. VEGETATION

Camp Roberts has three types of vegetative cover; forests, grasslands, and scrub. The location and extent of the three types are shown on the accompanying map. Details concerning each, including assessments of cover and concealment, are given in the table below. The forests and grasslands are the most significant of the three vegetation types in relation to military maneuvers and other training activities. In combination, they cover approximately 80–90% of the reservation's 44,000 acres. Scrub and open (Cantonments) lands are relatively insignificant in area coverage.

Forests:

Forest cover is predominantly deciduous. Oaks, sycamores, and cottonwoods are the dominant species. With few exceptions, forest understory is nonexistent. The undergrowth consists mainly of grasses and forbs.

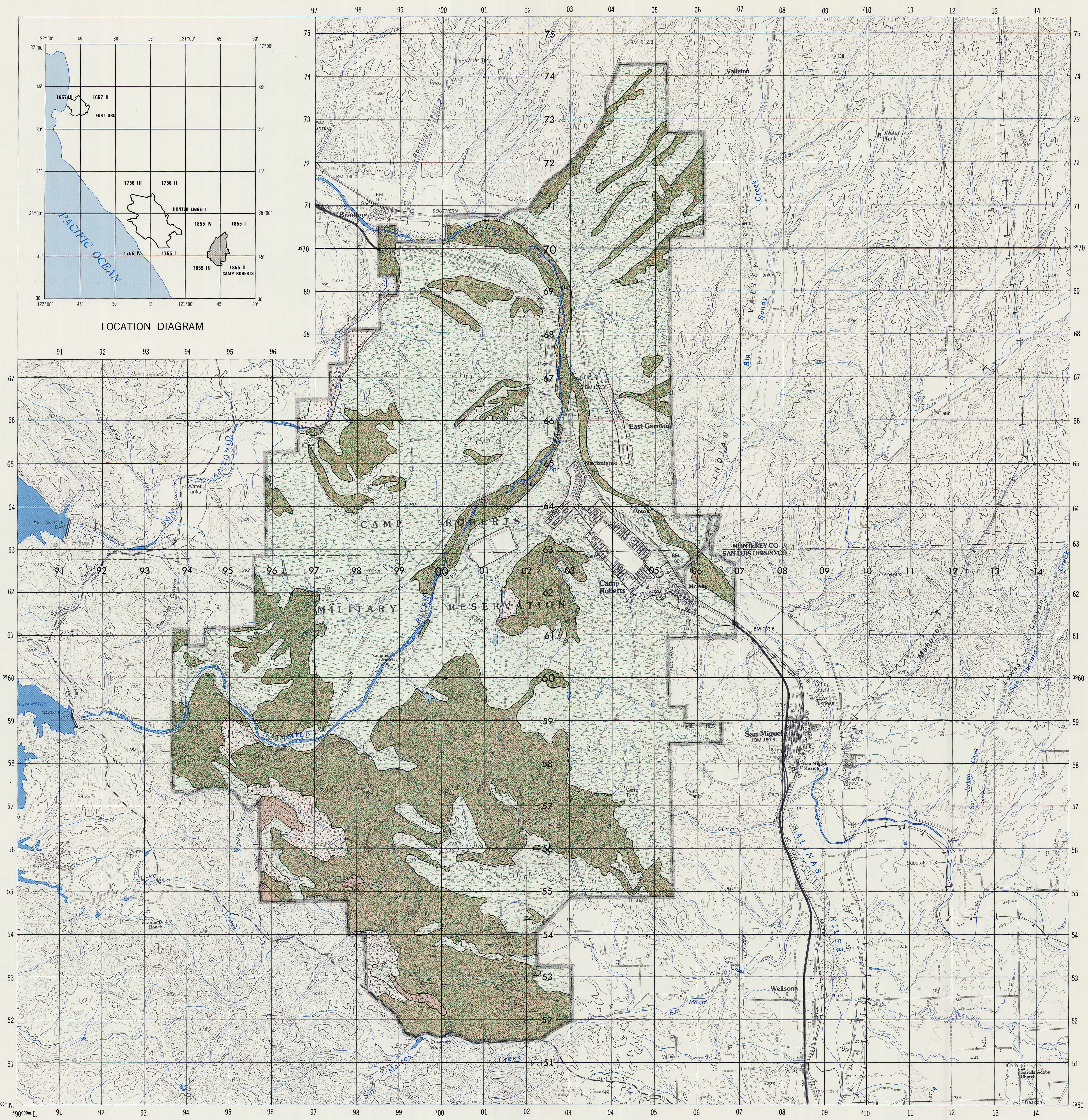
Grasslands:

The dominant vegetation on Camp Roberts is short grasses. Grass species include foxtail, ryegrass, and wild oats. Scattered trees, not exceeding 10% crown cover density, exist.

Scrub:

Mixed deciduous and coniferous scrub is quite limited compared to the area covered by forests and grasslands. Existing areas are principally confined to higher elevations in the western portion of Camp Roberts.

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
1	Deciduous trees; 10–15% crown cover density; the dominant species is California live oak; up to 8 m (26 ft) in height; multi-stemmed; scrub trees and scattered brush occur; undergrowth is fairly open consisting of grasses and forbs; trees generally widely spaced. Species such as sycamores and cottonwoods exist in the stream bottoms; undergrowth here varies from sparse to dense brush; 75% or more of each stand composed of deciduous species.	Map unit covers approximately 30–40%; extensive stands throughout; largest stand in southern portion of the reservation; continuous stands also exist in the Salinas River Valley and the lower reach of the Nacimiento River Valley.	The tallest trees on Camp Roberts exist along the major rivers. Brush density varies due to the amount of rainfall and distance from a water source. Scattered dense stands occur along the various streams, generally not large enough to map.	Cover for foot troops from flat-trajectory fire of small arms is poor.	Concealment from aerial and ground observation is poor for both foot troops and vehicles.
2	Mixed deciduous and coniferous scrub; 50–100% canopy closure*, most areas extremely dense; species include manzanita, chamise, chaparral, and California live oak; heights up to 1.5 m (5 ft); roughly equal distribution of deciduous and coniferous species. *Canopy closure is used for scrub, since true crowns are lacking on this low growing scrub.	Covers small portion of reservation, primarily in southwest, occurring on slopes and at higher elevations.		Cover for foot troops from flat-trajectory fire of small arms is poor.	Concealment from aerial and ground observation is poor for both foot troops and vehicles; limited concealment for foot troops in prone position.
3	Mixed deciduous and coniferous scrub; 10–50% canopy closure (See Map Unit 2); spacing varies from sparse to dense; species include manzanita, chamise, chaparral and California live oak; low growing, heights up to 1.5 m (5 ft); roughly equal distribution of deciduous and coniferous species.	Covers small portion of reservation, primarily on western edge, occurring on slopes and at higher elevations.		Cover for foot troops from flat-trajectory fire of small arms is poor.	Concealment from aerial and ground observation is poor for foot troops and vehicles; limited concealment for foot troops in prone position.
4	Short grasses; less than 1 m (3 ft) in height; species include foxtail, ryegrass, and wild oats; includes some small bare areas usually in stream valleys and dry washes of larger stream beds; some scattered trees, not to exceed 10% crown cover density.	Occurring throughout reservation, largest areas in central and northern half. Covers approximately 50% of Camp Roberts.	Grazing permitted in some areas.	No cover for foot troops.	No concealment for foot troops or vehicles.



CAMP ROBERTS, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

VEGETATION

FORESTS

1. Deciduous trees; medium to dense spacing.

SCRUB

2. Mixed scrub, medium to dense spacing.
3. Mixed scrub, nearly open to medium spacing.

GRASSLAND

4. Short grasses.

OPEN

OPEN

5. Built-up areas; barren areas, and heavily used areas. Vegetation not a significant factor.

NOTE: Number refers to entry in table.

NOTE: The military reservation boundary shown on this map does not reflect changes that occurred in 1977.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

H. CLIMATE

Camp Roberts lies approximately 48 km (30 mi) southeast of Fort Hunter Liggett along the western side of the Salinas Valley. The Santa Lucia Range parallels the reservation on the west. The climate of Camp Roberts is mild with warm temperatures during the winter. Precipitation is comparatively light, averaging 282 mm (11.1 in) per year, most of which falls during the winter. Snow is rare and invariably melts upon contact with the ground. Winds are light throughout most of the year.

Warm weather prevails during the summer months. Mean maximum temperatures during July, August, and September average 33°C (92°F). Extreme readings of 38°C (100°F) or above can occur between May and October, and the record high temperature is 46.1°C (115°F). There are normally 82 days of 32.2°C (90°F) or above. Winter mean minimum temperatures average slightly above 0°C (32°F) with only 59 days per year with readings at or below freezing. At specific sites temperatures of 0°C (32°F) can occur in May and September due to the physiographic setting of the reservation. Cold air from the mountains in the west settles in the valleys overnight, causing some large variations in temperature. On infrequent occasions temperatures have reached the teens, but such cold is of short duration.

Only about 7% of the annual percipitation falls during the six-month period from May through October. Normally 27 days of the year receive 2.54 mm (0.1 in) or more of precipitation, with only 7 days receiving 12.7 mm (.5 in) or more. Totals vary considerably from year to year ranging from less than 180 mm (7 in) to more than 640 mm (25 in). Stored moisture in the soil is usually sufficient to keep vegetation green until early June.

Winds are usually light with the prevailing direction from the northwest. The highest wind speed (peak gust) in 29 years of record is 53.7 kmph (29 knots).

CLIMATIC SUMMARY

PARAMETER DESCRIPTION		UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	YEARS OF RECORD
Temperature																
Absolute maximum temperature		(°C)	23.9	27.2	29.4	35.6	37.8	46.1	46.1	42.8	44.4	39.4	32.8	28.3	46.1	29
		(°F)	75	81	85	96	100	115	115	109	112	103	91	83	115	
Mean daily maximum temperature		(°C)	14.4	16.7	18.9	22.8	25.6	30.6	34.4	33.9	31.7	26.7	20.6	15.6	24.4	29
		(°F)	58	62	66	73	78	87	94	93	89	80	69	60	76	
Mean daily minimum temperature		(°C)	0.6	2.2	3.3	5.0	7.2	9.4	11.7	11.1	10.0	6.7	2.8	0.6	6.1	29
		(°F)	33	36	38	41	45	49	53	52	50	44	37	33	43	
Absolute minimum temperature		(°C)	−9.4	−7.2	−5.6	−2.8	1.1	2.8	6.7	5.6	2.2	−2.8	−7.8	−8.3	−9.4	29
		(°F)	15	19	22	27	34	37	44	42	36	27	18	17	15	
Mean no. days with maximum temperature ≧90 F (32.2 C)		days	0	0	0	1.1	3.6	12.2	23.1	21.5	15.7	5.0	0.2	0	82.4	29
Mean no. days with minimum temperature ≦32 F (0.0 C)*		days	15.9	10.3	5.8	1.7	0	0	0	0	0	1.2	8.3	16.0	59.2	29
Mean dew point temperature		(°C)	2.8	3.3	3.9	6.7	6.1	7.2	9.4	9.4	8.9	5.0	4.4	3.3	6.1	29
		(°F)	37	38	37	44	43	45	49	49	48	41	40	38	43	
Precipitation and Humidity																
Mean percent relative humidity		%	79	73	70	68	60	57	51	55	55	56	67	79	64	7
Mean percent relative humidity at 0400 LST		%	95	94	97	95	90	81	72	68	80	80	96	98	87	29
Mean percent relative humidity at 1300 LST		%	56	46	50	42	33	29	26	25	25	30	50	54	39	29
Mean no. days with precipitation ≧0.01 in. (0.25 mm)		days	4.6	4.6	4.6	3.2	0.9	0.3	0.4	0.3	1.0	1.4	2.6	4.8	28.7	29
Mean no. days with precipitation ≧0.5 in. (1.3 mm)		days	2	1	1	1	#	0	0	0	#	#	1	1	7	7
Mean monthly precipitation		mm	50.8	50.8	48.3	30.5	7.6	0.5	1.3	0.5	2.5	7.6	30.5	53.3	281.9	29
		in	2.0	2.0	1.9	1.2	0.3	0.02	0.05	0.02	0.1	0.3	1.2	2.1	11.1	29
Absolute maximum 24 hour precipitation		mm	83.8	91.4	35.6	27.9	2.5	1.3	2.5	1.0	7.6	33.0	78.7	78.7	91.4	29
		in	3.3	3.6	1.4	1.1	0.1	0.05	0.1	0.04	0.3	1.3	3.1	3.1	3.6	29
Mean no. days with thunderstorms		days	0.1	0.1	0.1	0.1	0.4	0.3	0.0	0.1	0.2	0.1	0.0	0.2	1.7	29
Snowfall			No recorded snowfall in 29 years of record													
Wind and Pressure																
Prevailing direction of wind		direction	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	29
Mean wind speed		kmph	6	6	6	7	7	7	7	7	6	6	6	6	6	29
		knots	3	3	3	4	4	4	4	4	3	3	3	3	3	29
Extreme wind speed (peak gust)		kmph	39	32	52	52	54	54	52	52	20	20	20	32	54	
		knots	21	17	28	28	29	29	28	28	11	11	11	17	29	29
Vapor pressure		cm Hg	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		in Hg	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pressure altitude (99.95%)		m	140	152	168	177	189	198	198	198	198	177	149	140	174	29
		ft	460	500	550	580	620	650	650	650	650	580	490	460	570	
Percent frequency of surface wind speed ≧28 knots (32.2 mph or 51.9 kmph)		%	0	0	0.1	0.1	0.2	0.4	0.2	0.1	0	0	0	0	0.1	7
Percent frequency of surface wind speed ≧17 knots (19.6 mph or 31.5 kmph)		%	2.3	2.9	4.6	6.5	10.3	13.7	11.8	8.8	5.0	2.6	2.0	2.0	6.0	7
Mean no. days with surface wind ≧17 knots (19.58 mph or 31.5 kmph) and no precipitation		days	1.4	2.7	4.1	7.4	12.4	16.3	15.5	14.5	7.7	3.9	0.8	0.7	87.4	7
Mean no. days with surface wind 4 – 10 knots (4.6 – 11.5 mph or 7.4 – 18.5 kmph) and temperature 33 – 89°F (0.6 – 31.7°C) and no precipitation		days	13.8	11.5	14.3	17.0	17.0	15.9	18.2	16.0	12.0	12.5	17.7	16.0	181.9	7
Visibility																
Mean cloudiness		tenths	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Mean no. days with fog (visibility less than 7 mi or 11 km)		days	8	3	4	3	1	1	0	2	2	3	5	6	38	7
Mean no. days with an occurrence of visibility less than 0.5 mi (0.8 km)		days	7.0	5.6	3.9	3.2	1.5	0.3	0.5	0.7	1.7	3.7	5.7	7.3	41.1	7
Percent frequency ceiling ≦5000 ft (1524 m) or visibility ≦5 mi (8 km)		%	31.9	21.8	23.1	21.5	14.9	13.4	4.5	7.3	9.9	8.7	18.9	27.5	17.0	7
Percent frequency ceiling ≦1500 ft (457 m) or visibility ≦3 mi (4.8 km)	for 0000–0200 LST	%	17.4	9.7	8.8	15.2	10.0	12.1	4.3	6.3	7.0	8.6	10.5	15.3	10.4	7
	for 0300–0500 LST	%	25.4	19.5	17.6	26.7	22.3	25.8	14.3	19.5	22.4	18.6	20.0	27.2	21.6	7
	for 0600–0800 LST	%	33.4	20.0	24.0	28.7	19.9	20.3	12.7	20.3	26.9	20.8	27.5	30.9	24.6	7
	for 0900–1100 LST	%	26.5	13.9	11.0	8.7	3.4	1.3	0.7	0.7	1.3	3.9	12.7	20.8	8.7	7
	for 1200–1400 LST	%	9.3	2.4	2.8	2.6	0.2	0.4	0.0	0.0	0.0	1.1	3.5	7.6	2.5	7
	for 1500–1700 LST	%	4.0	2.4	1.8	1.1	1.4	1.0	0.0	0.0	0.0	1.1	2.7	7.4	2.0	7
	for 1800–2000 LST	%	3.6	2.6	1.4	1.7	2.5	1.2	0.0	0.5	0.0	0.7	2.7	4.9	1.8	7
	for 2100–2300 LST	%	7.7	3.9	1.8	4.1	3.2	2.9	0.7	1.4	0.2	1.6	4.4	7.1	3.3	7
Percent frequency ceiling ≦300 ft (914 m) or visibility ≦1 mi (1.6 km)	for 0000–0200 LST	%	4.1	3.6	1.2	2.4	0.5	0.2	0.2	0.0	0.4	4.1	4.3	5.2	2.2	7
	for 0300–0500 LST	%	12.2	9.5	7.4	7.8	4.3	1.5	1.4	2.2	3.3	10.4	9.7	14.8	7.0	7
	for 0600–0800 LST	%	18.1	18.3	11.0	7.6	2.9	0.0	0.5	2.0	5.6	11.5	14.8	18.5	9.3	7
	for 0900–1100 LST	%	10.9	5.7	1.4	0.2	0.0	0.0	0.0	0.0	0.0	0.7	4.0	9.7	2.7	7
	for 1200–1400 LST	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	7
	for 1500–1700 LST	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	7
	for 1800–2000 LST	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
	for 2100–2300 LST	%	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.8	0.9	0.2	7
Mean no. days with sky cover ≦30% and visibility ≧3 mi (4.8 km)	at 1600 LST	days	10.0	12.6	12.6	15.0	19.7	24.5	26.7	27.8	24.8	24.8	17.1	11.6	227.2	7
	at 2200 LST	days	15.0	17.4	20.0	20.5	24.0	25.3	28.8	28.6	27.5	27.2	21.1	17.5	272.9	7
	at 0400 LST	days	12.3	15.1	15.0	13.0	17.1	16.6	22.2	21.6	19.3	21.3	17.1	13.6	204.2	7
	at 1000 LST	days	8.2	12.6	10.8	14.0	19.2	22.4	26.3	27.0	25.3	23.8	14.9	10.3	214.8	7
Mean no. days with ceiling ≧1000 ft (305 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	30.7	27.7	30.8	30.0	30.7	30.0	31.0	31.0	30.0	31.0	29.7	30.0	362.6	7
	at 2200 LST	days	29.5	27.8	31.0	29.5	30.5	29.6	31.0	30.5	30.0	31.0	29.3	30.1	360.2	7
	at 0400 LST	days	24.5	23.5	26.5	23.6	25.3	24.1	26.7	26.3	24.0	26.2	24.8	23.8	299.3	7
	at 1000 LST	days	24.3	25.3	29.3	29.2	30.7	30.0	31.0	31.0	30.0	30.3	27.3	25.5	343.9	7
Mean no. days with ceiling ≧2000 ft (610 m) and visibility ≧3 mi (4.8 km) and surface wind ≦10 knots (11.5 mph or 18.5 kmph)	at 1600 LST	days	28.0	12.4	11.3	7.5	4.8	2.9	1.8	2.7	5.8	10.7	17.3	21.4	116.6	7
	at 2200 LST	days	24.6	24.8	24.5	21.5	18.0	15.5	24.8	22.8	22.8	26.2	27.6	26.8	280.1	7
	at 0400 LST	days	21.0	21.2	23.2	19.5	22.3	18.9	26.2	24.8	22.5	24.3	22.1	21.7	267.7	7
	at 1000 LST	days	18.5	20.4	21.0	21.0	20.6	20.8	23.0	25.5	26.6	26.7	22.6	19.2	265.9	7
Mean no. days with ceiling ≧2500 ft (762 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	27.5	26.3	29.1	29.0	30.5	29.5	31.0	31.0	30.0	30.7	28.4	28.4	351.4	7
	at 2200 LST	days	26.7	25.8	29.3	28.5	29.5	29.0	31.0	30.5	29.6	30.7	28.3	27.7	356.6	7
	at 0400 LST	days	21.6	21.4	23.9	20.3	22.5	20.3	26.0	24.6	22.0	24.8	22.4	21.7	271.5	7
	at 1000 LST	days	19.8	22.0	26.7	25.7	29.5	28.8	20.7	30.7	29.8	29.6	24.6	21.5	320.4	7
Mean no. days with ceiling ≧6000 ft (1829 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	25.1	23.4	26.5	26.5	29.1	29.1	31.0	30.8	29.3	30.3	27.0	26.4	334.5	7
	at 2200 LST	days	22.8	23.9	26.9	26.8	28.6	28.3	30.8	30.5	29.3	30.5	26.4	25.5	330.3	7
	at 0400 LST	days	18.2	19.7	20.2	18.8	21.3	19.7	26.0	24.6	21.8	24.8	21.0	18.9	255.0	7
	at 1000 LST	days	17.1	21.5	22.4	23.6	27.0	27.4	30.7	30.3	29.3	29.1	23.6	19.2	301.2	7
Mean no. days with ceiling ≧10,000 ft (3048 m) and visibility ≧3 mi (4.8 km)	at 1600 LST	days	24.3	22.8	25.2	25.3	28.8	28.8	30.7	30.8	29.2	29.8	26.4	25.2	327.3	7
	at 2200 LST	days	22.5	23.0	26.0	26.6	28.6	28.1	30.7	30.5	29.3	30.3	26.0	24.5	326.1	7
	at 0400 LST	days	17.6	19.2	19.8	18.3	21.1	19.4	26.0	24.3	21.7	24.5	20.9	18.2	251.0	7
	at 1000 LST	days	16.6	20.9	21.9	23.0	26.7	26.9	30.5	30.2	29.2	28.8	23.4	18.4	296.5	7

LST = Local Standard Time — = No data # = Less than 0.5 day

EPHEMERIS FOR CAMP ROBERTS, CALIFORNIA
(Pacific Standard Time)

DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET
January 1	0613	1800	0713	1700	April 1	0454	1921	0550	1825	July 1	0342	2031	0450	1923	September 21	0454	1857	0550	1802
January 11	0614	1808	0713	1709	April 11	0438	1930	0536	1833	July 11	0348	2028	0456	1921	October 1	0502	1842	0558	1747
January 21	0612	1817	0710	1719	April 21	0424	1940	0523	1841	July 21	0357	2021	0502	1916	October 11	0511	1828	0606	1733
February 1	0606	1827	0703	1730	May 1	0410	1951	0511	1850	August 1	0407	2010	0511	1907	October 21	0519	1816	0615	1720
February 11	0558	1837	0654	1741	May 11	0358	2001	0501	1858	August 11	0417	1958	0518	1857	November 1	0528	1804	0625	1708
February 21	0548	1846	0643	1750	May 21	0349	2011	0454	1906	August 21	0427	1944	0526	1845	November 11	0537	1756	0635	1659
March 1	0538	1853	0633	1758	June 1	0341	2020	0448	1913	September 1	0437	1928	0535	1831	November 21	0546	1751	0645	1653
March 11	0525	1902	0620	1807	June 11	0338	2027	0446	1919	September 11	0446	1913	0542	1816	December 1	0555	1749	0654	1650
March 21	0510	1910	0606	1815	June 21	0338	2031	0447	1922						December 11	0603	1750	0703	1650
															December 21	0609	1753	0709	1653

I. CROSS-COUNTRY MOVEMENT

Cross-country movement (CCM) conditions, or off-road movement, at Camp Roberts, are shown on the accompanying map. Additional details are provided in the following text and table. CCM conditions have been derived mainly from vegetation, soils, and surface configuration data prepared for and appearing separately in this terrain analysis. Supplemental sources included 1:30,000 scale aerial photography, topographic maps, field notes and photography, and miscellaneous textual material.

The map and predicted movement evaluations should be used only as guides in planning military training activities. For exact movement routes, reconnaissance on the ground is recommended. Data on the terrain factors and the evaluations are generalized to suit the scale of the map. Many areas of minor areal extent such as small tracts of forest, cleared areas, short sharp slopes, and depressions, are too small to portray.

The predicted movement ratings are those believed to prevail during most of the year. Variations in these evaluations may occur from year to year, and even within a season, due to abnormal variations in the weather. Normally, movement will be degraded two or three days per month during the period from about November through April, the time of the winter rains. During periods of dry weather, severe dust problems may occur in areas with little or no vegetation, causing limited visibility.

The evaluations are based on terrain conditions as they are known at present. Future alterations of the terrain, such as timber clearing operations, dam and reservoir building, and road construction, would obviously change cross-country movement conditions.

Built-up areas, such as urban and cantonment areas, are not evaluated on this map.

Movement in the indicated impact areas may be restricted during periods of live fire. Caution should be taken when moving through these areas because of the existence of unexploded ammunition.

GENERAL TERRAIN AND MOVEMENT DESCRIPTION

MAP UNIT	GENERALIZED TERRAIN CONDITIONS	MOVEMENT OF TRACKED VEHICLES 1/	MOVEMENT OF WHEELED VEHICLES 2/	MOVEMENT OF FOOT TROOPS
1	Gently sloping grass-covered valleys including significant areas of bare ground usually associated with stream valleys and dry washes of the larger streambeds. Most slopes are less than 5 percent with some ranging as high as 8 percent. Soils predominantly deep shaly loams with some sandy loam along the steeper slopes. Some clay loam concentrations along stream channels. Grasses generally less than 1 m (3 ft) tall. Trees widely scattered throughout area.	Generally easy in any direction for both tank and APC. Local obstructions can easily be bypassed. Grass-cover reduces dust problems during dry weather. Narrow valleys restrict movement and should be avoided when there is a possibility of flash flooding.	Fairly easy most of the year in any direction for both truck and jeep. Slipperiness will slow movement in clayey areas when wet. Narrow valleys restrict maneuverability and drainage channels will slow movement speeds. Narrow valleys should be avoided during possible flash flooding periods.	Unhindered in most instances. Movement hindered slightly during and after periods of rainy weather due to stickiness and slipperiness of soils in some areas.
2	Moderately sloping grassland with widely scattered tree areas generally located between valley and upland regions. Slopes generally 8 to 30 percent. Soils are sandy or loamy. Vegetation is primarily short grass less than 1 m (3 ft) high. Widely scattered trees or clumps of trees cover about 20 percent of the area.	Generally unrestricted through out the year. Scattered trees and other local obstacles easily bypassed. Wet soils may restrict movement during long rainy periods. Soft soil conditions last somewhat longer on loamy soils than sandy soils, but low strength soil conditions seldom exceed more than 2 days.	Somewhat hindered by moderate slopes. Upslope movement is severely restricted when grasses wet. Wet soils conditions will also affect traction of vehicles causing less maneuverability.	Unhindered in most instances except during prolonged rainy periods.
3	Moderately to highly dissected grass-covered uplands with interspersed woodlands generally located on hillsides. Slopes mostly range between 30 and 45 percent. Soils mainly mixed sandy loam containing varying amounts of gravel, cobbles, and stones.	Moderately slowed by steepness of slopes. Local areas of dense trees require bypassing. Soils offer firm support when either dry or wet. Wet grassy slopes additional hindrance to maneuverability.	Moderately to severely restricted by steepness of slopes. Slipperiness of grass during wet periods precludes movement on steeper slopes. Stony areas restrict jeep movement more than truck.	Movement slowed by moderate slopes. Wet grasses and stony areas will further slow rate of movements.
4	Moderately to densely vegetated areas on gentle to moderate slopes of low hills. Slopes range between 3 and 30 percent. Soils are generally clay loam, sandy loam, and gravel. Vegetation consists of low-growing brush and scrub intermixed with patches of trees randomly spaced. Trees generally spaced 1 to 4 m (3–13 ft) apart.	Moderately restricted by patches of trees and low scrub growth; patches of trees generally require bypassing.	Moderately restricted by patches of trees and scrub growth; patches of trees generally require bypassing.	Moderately restricted by large clumps of scrub vegetation. During and after precipitation, slipperiness or stickiness of soil will further hinder movement.
5	Moderate to dense brush- and scrub-covered upland areas generally located between valleys and steeply sloping areas. Slopes are moderate, varying between 8 and 30 percent. Soils are mainly sandy loam gravel, and some shaly clay.	Moderately restricted by areas of medium to dense vegetation. During wet periods, slipperiness of the steeper slopes in combination with wet vegetation will further hinder movement.	Movement generally unsuited due to areas of medium to dense vegetation.	Moderately hindered by medium to dense vegetation.
6	Scattered areas of dense brush and scrub located along base of the gently rolling hills in the southern portion of Camp Roberts. Slopes mainly gently to moderate (0 to 30 percent). Soils mainly sandy loams or shaly clays. The extremely dense brush is up to 1.5 m (5 ft) tall.	Moderately slowed by dense brush and scrub. Tank movement is somewhat easier than that of the APC.	Movement generally unsuited for wheeled vehicular movement due to dense vegetation and moderate slopes.	Practically impenetrable to movement due to extremely dense brush and scrub.
7	Moderate to steep hills covered with dense brush and scrub. Slopes generally between 30 and 45 percent. Clay and sandy soils firm, except clays commonly slippery when wet. Medium to dense brush and scrub growth predominates in this area.	Tank and APC movement not practical due to medium to dense vegetation in combination with moderate to steep slopes.	Generally unsuited. Steepness of slopes restricts truck and jeep movement to a minimum.	Movement is severely restricted due to dense vegetation. Additionally slowed when clayey soils wet and slippery.
8	Predominantly hilly terrain covered with dense brush and thickets with numerous scattered rock outcrops. Slopes are generally steep, ranging between 45 and 100 percent. Soils are generally shallow sands, clays, and gravels over weathered bedrock. Vegetation is primarily scrub up to 1.5 m (5 ft) in height along the hillsides and scattered patches of scrub trees in the stream valleys.	Terrain is unsuited for off-road movement. Thick brush, steep slopes, and jagged rock outcrops preclude movement of the tank and APC.	Precluded at all times due to dense vegetation and steep slopes.	Movement severely slowed during both wet and dry periods due to steep, scrub-covered slopes.
9	Built-up areas with medium to high density of construction, such as urban and cantonment areas.	Not evaluated	Not evaluated	Not evaluated

1/ Comments apply to the M-60 tank and the M-113 armored personnel carrier (APC).

2/ Comments apply to the M-35, 2½ ton truck and the M-151, ¼ ton truck.

J. LINES OF COMMUNICATION

Lines of Communication (LOC) at Camp Roberts are depicted on the accompanying map. Supportive textual information for LOC as shown on the graphic is provided in the tables following this summary.

ROADS: The road network of Camp Roberts consists of hard surface, loose surface, improved and unimproved dirt roads and tank trails. The total length of the road system shown on the map is 241 kilometers (150 miles), excluding tank trails. Any dirt road on post can serve as a tank trail, usually referred to as tactical roads/tank trails. Improved tank trails are graded out to 24 feet wide and have a layer of compacted gravel. Approximately 134 kilometers (83 miles) of road system is hard surface. Some hard surface and dirt roads have been omitted from the graphic. Selected dirt roads depict the prevailing patterns and system connections. Data on military load classification and road shoulder characteristics are not available. The Main and East Garrison is laid out in a pattern of avenues numbered 1 thru 67 in a general Southwest–Northeast direction, with the major thoroughfares identified as roads or state-named avenues. US Highway 101 traverses the Northeastern portion of the reservation and is a vital link to the Camp Roberts complex. Refer to Roads, Camp Roberts, for individual road details.

ROAD BRIDGES: There are eleven road bridges within the reservation boundary. The majority of the bridges are rated in good to excellent condition. Refer to Road Bridges, Camp Roberts, for details pertaining to each bridge.

RAILROADS: The Southern Pacific Railroad Company serves the main cantonment area of Camp Roberts. Total length of trackage within the reservation boundary, including sidings, is approximately 17.8 kilometers (11.1 miles). The volume of traffic has not been determined due to the temporary and seasonal use of the facilities. Refer to Railroads, Camp Roberts, and Railroad Bridges, Camp Roberts for details.

AIRFIELDS: Camp Roberts Army Airfield is the only active airfield within the reservation boundary and is utilized by fixed wing aircraft. Refer to Airfields, Camp Roberts, for details.

PIPELINES: There is one pipeline on the reservation. It is an oil pipeline running across the Southwest corner. Refer to Pipelines, Camp Roberts, for additional details.

HELICOPTER LANDING ZONES (HLZ): There are four recognized HLZs on Camp Roberts. The large paved parade field in the cantonment area is the prime site for helicopter landings. For details on this and other designated HLZ sites refer to Helicopter Landing Zones, Camp Roberts.

1. ROADS

ROUTE NUMBER/ NAME 1/	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ CONDITION	REMARKS
A Street	043638	048636	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Albany Way	062615	063617	.1 km (0.8 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Arizona Blvd	028643	046623	2.5 km (1.6 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Avery Road	958625	983609	3.7 km (2.3 mi)	No data	Fair-Weather	Gravel	6 m (20 ft); No data	No data	No data	
Ave 1	052617	053618	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 2	051618	053620	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 3	049621	051623	.2 km (.14 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 6	043623	045624	.2 km (.14 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 7	043624	049629	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	043624	044625	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	047627	049629	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 8	041624	047630	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	041624	043626	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	046628	047630	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 9	040625	047632	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	040625	043627	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	045629	047632	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 10	039626	046633	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	039626	042627	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	045631	046633	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 11	038627	045634	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	038627	041629	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	044632	045634	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 12	037627	044634	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	037627	040629	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	043633	044634	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 13	037628	044635	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	037628	039631	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	043633	044635	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 14	036629	043636	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	036629	038632	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	041634	043636	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	

J. LINES OF COMMUNICATION (Continued)

1. ROADS (Continued)

ROUTE NUMBER/ NAME 1/	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ CONDITION	REMARKS
Ave 15	035631	042637	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	035631	037633	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	040635	042637	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 18	035637	037638	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 19	034638	036639	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 21	032638	034640	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 22	026636	031639	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 23	025635	031641	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 23	031643	032642	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 24										
Segment 1	024636	026639	.7 km (.45 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	031644	032643	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 25	032645	033644	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 26	032647	034646	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 27	032648	034648	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft);	No data	No data	
Ave 28	032648	033649	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 29	031649	032651	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 50	043649	044650	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 51	043652	044653	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 52	043653	044653	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 53	043654	044654	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 54	043655	044655	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 55	042656	044656	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 56	042656	044657	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 57	042657	044658	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 58	041660	043661	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 59	040661	043662	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 60	040662	043663	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 61	039663	041664	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 63	035664	040665	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 64	038665	040666	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 66	036667	039668	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Ave 67	036668	038669	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
B-3 Road	992689	001658	2.7 km (1.7 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
B-4 Road	003658	024667	2.2 km (1.4 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
B-9 Road	980675	988636	4.4 km (2.8 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Bee Rock Road	956625	065585	11.6 km (7.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 1	956625	043595	9.3 km (5.9 mi)	No data	Fair-Weather	Gravel	7 m (23 ft); Fair-Good	No data	No data	
Segment 2	043595	052591	1 km (.6 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Segment 3	052591	065585	1.2 km (.8 mi)	No data	Fair-Weather	Gravel	7 m (23 ft); Fair-Good	No data	No data	
Bivouac Road	970608	958587	3 km (1.9 mi)	No data	Fair-Weather	Gravel	4 m (12 ft); Fair-Good	No data	No data	
B Street	053624	056621	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Boy Scout Road	947596	987587	3.8 km (2.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Boston Way	063614	064615	.1 km (.08 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Boundary Road	946596	967552	5.4 km (3.4 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Bradley Road	988698	025654	7.0 km (4.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Bridge Road	027654	028644	.8 km (.5 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
C-11 Road	962619	985614	2.5 km (1.6 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.

ROADS (Continued)

ROUTE NUMBER/ NAME 1/	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIAL	SURFACE WIDTH/ CONDITION	SHOULDERS CONSTRUCTION MATERIAL	SHOULDERS WIDTH/ CONDITION	REMARKS
C-25 Road	956598	972618	2.2 km (1.4 mi)	No data	Fair-Weather	Gravel	4 m (12 ft); Fair	No data	No data	
California Blvd	032635	040637	1 km (.6 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Canyon Road	015611	005559	6 km (3.8 mi)	No data	Fair-Weather	Gravel	5 m (16 ft); Fair-Good	No data	No data	
						Dirt	5 m (16 ft); Fair	No data	No data	
Segment 1	015611	015590	1.9 km (1.2 mi)	No data	Fair-Weather	Gravel	5 m (16 ft); Fair-Good	No data	No data	
Segment 2	015590	005559	4.1 km (2.6 mi)	No data	Fair-Weather	Dirt	5 m (16 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Chalk Road	002548	987532	2 km (1.3 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Chicago Way	064614	065615	.1 km (.07 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Colorado Ave	026639	030642	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Deer Trail Road	977565	981542	4.4 km (2.8 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Denver Way	063614	064615	.1 km (.07 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
East Perimeter Road	045620	015540	10.3 km (6.5 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
El Paso Way	065613	066614	.1 km (.07 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Escarpment Road	021668	003658	2.7 km (1.7 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair-Good	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
E Street	046626	048624	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
F-1 Road	978569	954575	2.9 km (1.8 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); No data	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
F-7 Road	996551	003556	.1 km (.06 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); No data	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
F-8 Road	988532	017534	3 km (1.9 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); No data	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
F-9 Road	008531	025525	1.9 km (1.2 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); No data	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
F Street	051622	053618	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); No data	No data	No data	
Field Road	028643	017635	1.4 km (.9 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Fresno Way	065613	066614	.1 km (.07 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
G Street	029642	027653	1.1 km (.7 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Gate 16 Road	015708	034687	3 km (1.9 mi)	No data	Fair-Weather	Gravel	7 m (23 ft); Fair-Good	No data	No data	
Gate 17 Road	033694	062727	4.3 km (2.7 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Gate 18 Road	035691	062707	3.2 km (2.0 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Gate 19 Road	041666	053670	1.3 km (.8 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Gary Way	065613	066614	.1 km (.06 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Generals Road	991603	015540	7.6 km (4.8 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Homestead Road	966552	974553	1 km (.6 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Idaho Ave	030641	029652	1 km (.7 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Industrial Road	051622	059616	1 km (.6 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Kansas Ave	046625	049621	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
K Street	028637	026638	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
L Street	024636	026635	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Last Chance Road	045608	025634	3.3 km (2.1 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Segment 1	034615	045608	1.4 km (.9 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Segment 2	034615	025634	1.9 km (1.2 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Montana Blvd	039636	047627	1.1 km (.7 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Michigan Ave	045620	049621	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
N Street	043649	034676	2.2 km (1.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Nacimiento Road	023635	033633	1.1 km (.7 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
North Dakota Ave	034639	036642	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Nevada Ave	036641	038637	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
New Mexico Ave	034633	039637	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
O Street	035672	042649	2.9 km (1.8 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	
Oat Spring Road	981542	996551	2.1 km (1.3 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Oil Well Road	991623	958625	5.7 km (3.6 mi)	No data	Fair-Weather	Gravel	6 m (20 ft);	No data	No data	
Ohio Ave	033634	028637	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair-Good	No data	No data	

ROADS (Continued)

ROUTE NUMBER/ NAME 1/	ROUTE LOCATION (GRID REFERENCE)		LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE		SHOULDERS		REMARKS
	FROM	TO				CONSTRUCTION MATERIAL	WIDTH/ CONDITION	CONSTRUCTION MATERIAL	WIDTH/ CONDITION	
Oregon Ave	049629	039636	1.3 km (.8 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
P Street	043649	041662	1.1 km (.7 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Poop Out Hill	044595	041574	2.1 km (1.3 mi)	No data	Fair-Weather	Gravel	7 m (23 ft); Fair–Good	No data	No data	
River Road	965587	937590	4.6 km (2.9 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
R Street	044650	038669	2.1 km (1.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
San Antonio Road	960629	985683	4.3 km (2.7 mi)	No data	Fair-Weather	Dirt	4 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
San Marcos Road	982527	931520	5.4 km (3.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
San Miguel Ave	049621	067613	1.8 km (1.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Sherwood Road	006637	015639	1.1 km (.7 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
South Dakota Ave	045620	049625	.6 km (.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Sulphur Spring Road	956570	977565	2.4 km (1.5 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Texas Ave	031641	032642	.2 km (.1 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Tower Road	952599	025654	10.2 km (6.4 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Track Way	063615	067613	.5 km (.3 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Turkey Road	991538	005531	1.6 km (1.0 mi)	No data	Fair-Weather	Dirt	3 m (10 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Utah Ave	034639	036635	.3 km (.2 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
US 101	985700	069613	13.7 km (8.6 mi)	No data	All-Weather	Asphaltic Concrete	20 m (66 ft); Excellent	No data	No data	
Washington Blvd	035633	044619	1.6 km (1.0 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
West Perimeter Road	016540	006628	12.4 km (7.8 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Windmill Road	968655	973640	1.6 km (1.0 mi)	No data	Fair-Weather	Dirt	3 m (12 ft); Fair	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Wyoming Ave	045624	047625	.4 km (.27 mi)	No data	All-Weather	Bituminous	7 m (23 ft); Fair–Good	No data	No data	
Additional Installation Routes (Unnamed)										
Improved Dirt Roads			32 km (20 mi) (Approximate)	No data	Fair-Weather	Gravel	4–7 m (12–23 ft); Fair	No data	No data	
Unimproved Dirt Roads			74 km (46 mi) (Approximate)	No data	Fair-Weather	Dirt	3–5 m (10–16 ft); Fair–Poor	No data	No data	Road may become slippery and miry after heavy rains, particularly during the winter and spring.
Tank Trails			45 km (28 mi) (Approximate)	No data	Fair-Weather	Dirt with some gravel	7–11 m (24–35 ft); Fair	No data	No data	

1/ Names listed alphabetically

ROAD BRIDGES

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION	DIMENSIONS LENGTH/OVERALL WIDTH/ ROADWAY WIDTH	CLEARANCE	TYPE/CONSTRUCTION MATERIAL	CONDITIONS	REMARKS
1	Old US-101 Overpass Ramp	029657	US-101	No data; civilian design of H-20, S-20-12, H20-S16, or HS20.	83 m (269.2 ft) long; overall width–No data; roadway width 9.2 m (30 ft).	Unlimited vertical; horizontal clearance–No data	Deck; steel–concrete girder	Excellent	Overpass; Cal. Dept. of Trans. bridge No. BR44–140; 1 sidewalk 1.5 m (5 ft); 15 m (48 ft) under bridge horizontal clearance; built in 1965.
2	Main Post Overpass Ramp	041638	US-101	No data; civilian design of H-20, S-20-12, H20-S16, or HS20.	59.4 m (194.5 ft) long; overall width–No data; roadway width 12.5 m (41 ft).	Unlimited vertical; horizontal clearance–No data	Deck; steel–concrete girder	Good–Excellent	Overpass; Cal. Dept. of Trans. bridge No. BR44–137; two sidewalks 3 m (10 ft); 15 m (48 ft) under bridge horizontal clearance; built in 1965.
3	US-101	027661	Nacimiento River	No data; civilian design of H-20, S-20-12, H20-S16, or HS20.	109 m (357 ft) long; overall width–No data; roadway width 8.5 m (28 ft) each span.	Unlimited vertical; horizontal clearance–No data	Deck; steel–concrete girder	Good–Excellent	Total width of double bridges 30 m (98 ft); Cal. Dept. of Trans. bridge No. BR44–139; 15 m (48 ft) underbridge horizontal clearance.
4	US-101	025666 Approximately	Unnamed equipment road	No data; civilian design of H-20, S-20-12, H20-S16, or HS20.	24.4 m (80 ft) long; overall width–No data; roadway width–No data.	Unlimited vertical; horizontal clearance–No data	Type–No data; steel–concrete	No data	Cal. Dept. of Trans. bridge No. BR44–173.
5	US-101	987689	San Antonio River and access road	No data; civilian design of H-20, S-20-12, H20-S16, or HS20.	152 m (497 ft) long; overall width–No data; roadway width 10 m (33 ft).	Unlimited vertical, 10.2 m (33 ft) to river bottom and 7.1 m (23 ft) to access road under bridge; horizontal clearance–No data	Deck; steel–concrete	Good–Excellent	Total width of double bridges 30 m (98 ft); Cal. Dept of Trans. bridge No. BR44–141.
6	US-101	068613	San Miguel Ave and Railroad spur	No data; civilian design of H-20, S-20-12, H20-S16, or HS20.	68 m (223.4 ft) long; overall width–No data; roadway width 10 m (33 ft).	Unlimited vertical; 6.7 m (22 ft) under bridge; horizontal clearance–No data	Deck; steel–concrete girder	Good–Excellent	Total width of double bridges 30 m (98 ft); Cal. Dept of Trans. bridge No. BR49–78; built in 1965.

ROAD BRIDGES (Continued)

BRIDGE NUMBER	ROUTE DESIGNATION	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION	DIMENSIONS LENGTH/OVERALL WIDTH/ ROADWAY WIDTHS	CLEARANCE	TYPE/CONSTRUCTION MATERIAL	CONDITIONS	REMARKS
7	Old US-101	032665	Salinas River and East Garrison access road	No data	351 m (1150 ft) long; overall width–No data; roadway width 10 m (33 ft).	Unlimited vertical; 7.3 m (25 ft) under bridge; horizontal clearance–No data	Deck; concrete	Good–Excellent	Built in 1940.
8	Bridge Road	026653	Nacimiento River	No data	171 m (562 ft) long; overall width 10.6 m (35 ft); roadway width 9.3 m (30 ft).	Unlimited vertical; 11.5 m (38 ft) under bridge to water; horizontal clearance–No data	Wood deck with asphaltic covering on timber tressel	Poor	Has been condemned.
9	Bee Rock Road	998620	Nacimiento River	No data	75 m (245 ft) long; overall width–No data; roadway width 7 m (23 ft).	Unlimited vertical; 1.5 m (5 ft) under bridge to water; horizontal clearance–No data	Wood deck stringers on concrete base	Good–Excellent	This is a low water bridge, designed so that high water will wash directly over the roadway.
10	Boy Scout Road	975587	Unnamed Creek	No data	12.2 m (40 ft) long; overall width 7.6 m (25 ft); roadway width 7.3 m (24 ft).	Unlimited vertical; 4.9 m (16 ft) under bridge to creek bed; horizontal clearance–No data	Wood deck with asphaltic covering on timber tressel	Fair	
11	Twin Bridges	946603	Nacimiento River	No data	49 m (160 ft) long; overall width 4.6 m (15 ft); roadway width 4.3 m (14 ft).	Unlimited vertical; 3 m (10 ft) under bridge to water; horizontal clearance–No data	Wood deck, timber	Fair	Actually two bridges in series split by a river island.

2. RAILROADS

MAP NUMBER	GRID REFERENCE FROM TO	LENGTH OF TRACK SEGMENT	OWNERSHIP AND CONDITION	TRACK AND BED CHARACTERISTICS	SIDINGS AND COORDINATES FROM TO	BALLAST MATERIAL	TRAFFIC VOLUME CAPACITY
Line 1	068614 – 015708	11.4 km (7.1 mi)	Southern Pacific Railroad Company (private); good condition	Single track, standard gauge, 1.44 m (4 ft 8 ½ in.); weight of rails 52 kg (115 lb).	777 m (2550 ft) long; 068613 – 062617 2149 m (7050 ft) long; 062617 – 057619 640 m (2100 ft) long; 054621 – 061617 915 m (3000 ft) long; 053622 – 062617 503 m (1650 ft) long; 062618 – 066616 1463 m (4800 ft) long; 053626 – 067615	Crushed stone	No data

RAILROAD BRIDGES

MAP NUMBER	GRID REFERENCE	FEATURE CROSSED	NUMBER OF TRACKS	ROADBED WIDTH	CLEARANCE HORIZONTAL	CLEARANCE VERTICAL	DECK MATERIAL	OVERALL LENGTH	TYPE OF STRUCTURE	REMARKS
1	032665	Salinas River and East Garrison access road	Single	4.9 m (16.2 ft)	4.9 m (16.2 ft)	Limited, but No data	Wood	335 m (1100 ft)	Steel Truss	Built in 1902

3. AIRFIELDS

NAME; LOCATION; TYPE; AND CLASSIFICATION	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS
Camp Roberts Army Airfield; Grid Reference 041632; Army National Guard Airfield.	Elevation: 192 m (630 ft) Status: Operational	Runway: 835 m long; 22.8 m wide (2740 ft long; 75 ft wide) Azimuth: 140° – 320° Weight Bearing Capacity: SWL 8 Surface Material and Condition: Bituminous surface in fair condition.	Taxiways: None Parking, Apron and Hardstand areas: ·Two bitumininous surface parking areas. Total area 10,036 m^2 (108,000 ft^2)	No data	20,000 gals JP-4 at 2 facilities.	Control Tower: Height 7.6 m (25 ft) above sea level. Old guard tower with glass installed. Communications: FSS Paso Robles Lighting: Field lighting on runway.

NOTE: Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following SWL. Runway weight bearing capacity given is for unlimited operations. Aircraft weights higher than given require prior permission from the aerodrome controlling authority.

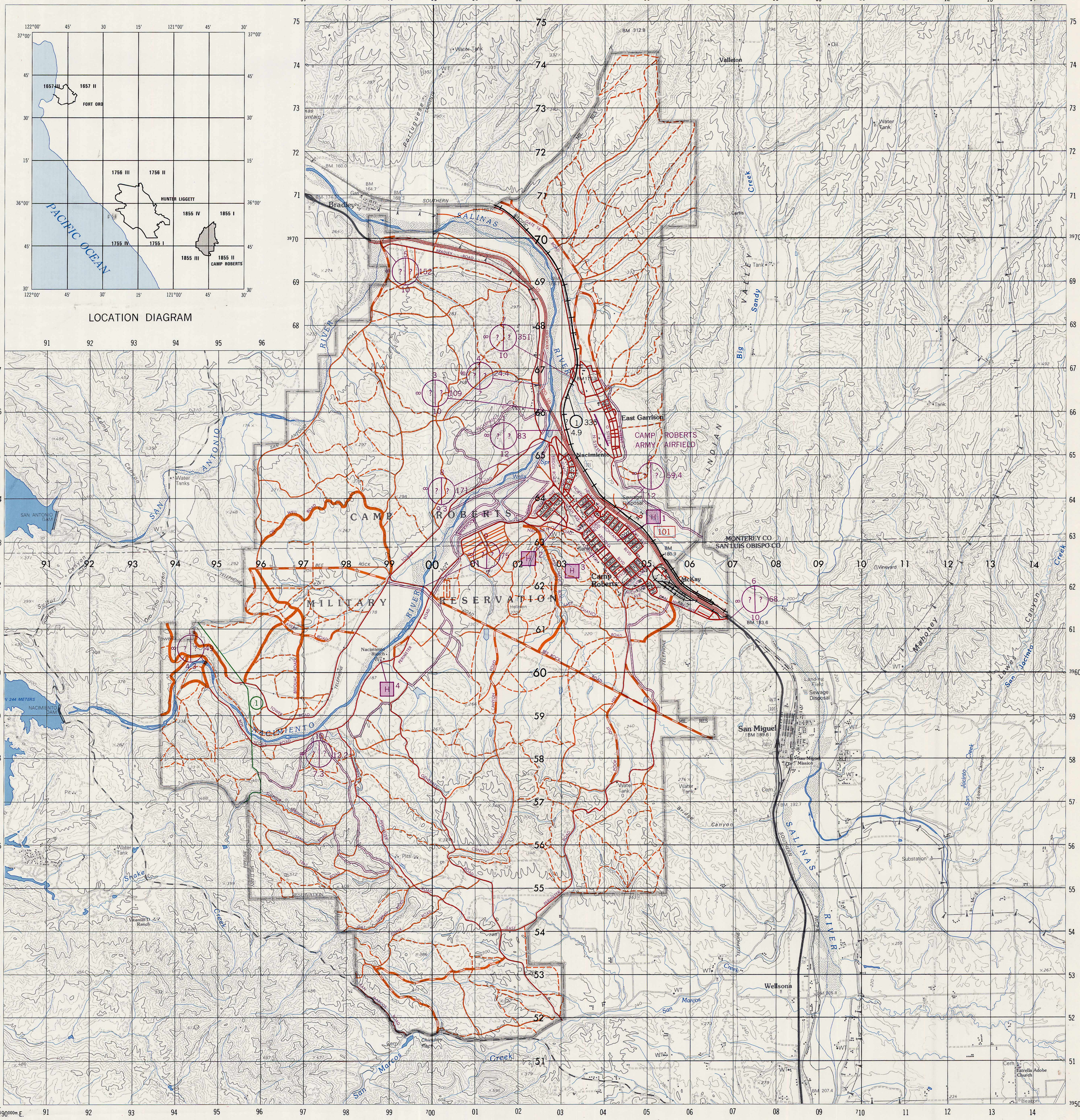
SWL – Single wheel loading. (This includes information submitted in terms of Equivalent Single-wheel Loading (ESWL) and Single Isolated Wheel Loading).

4. PIPELINES

MAP NUMBER	GRID REFERENCE FROM	GRID REFERENCE TO	LENGTH OF SEGMENT	OWNERSHIP	PIPE CONSTRUCTION MATERIAL	PIPE SIZE	MATERIAL CARRIED	REMARKS
1	945612	957570	4.8 km (3.0 mi)	Mobil Oil Corp.	No data	No data	Crude Oil	

5. HELICOPTER LANDING ZONES

MAP NUMBER	LOCATION (GRID REFERENCE)	DIMENSIONS	AZIMUTH	ELEVATION	SURFACE MATERIAL	RESTRAINTS	REMARKS
1	043631	No data	No data	201 m (660 ft)	Bituminous	None	Helipad markings on parade ground.
2	032637	No data	No data	216 m (710 ft)	Asphalt	Flagpole	Near Post Headquarters.
3	041629	No data	No data	194 m (635 ft)	Asphalt	No data	In front of dispensary on east side of the parade ground.
4	988603	No data	No data	183 m (600 ft)	5 cm (2 in) compacted gravel	No data	Near General's Quarters at the Nacimiento Ranch complex.



CAMP ROBERTS, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

LINES OF COMMUNICATION

ROADS

- Hard surface, divided, 4 or more lanes
- Hard surface, 2 or 3 lanes
- Loose surface, 2 or more lanes
- Loose surface, 1 lane
- Improved dirt
- Unimproved dirt
- Tank trail
- 101 State route marker

BRIDGE DATA (ROADS)
(measurements in meters)

- A Bridge number
- B One-way military load classification; (T) tracked
- C One-way military load classification; (W) wheeled
- D Roadway width
- E Length
- F Vertical clearance
- ∞ Unlimited vertical clearance
- ? No data available

NOTE: The military reservation boundary shown on this map does not reflect changes that occurred in 1977.

RAILROADS
(measurements in meters)

1 Railroad and identification number

RAILROAD BRIDGE

- A Bridge number
- B Vertical clearance
- C Horizontal clearance
- D Length

AIRFIELDS

Airfield

PIPELINES

1 Pipeline and identification number

HELICOPTER LANDING ZONES

H 4 Landing zone and identification number

NOTE: Number refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

K. URBAN AREAS (CANTONMENT AREAS)

TROOP BILLETS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
Semi-permanent	40	2080	Fair	The number of personnel on post varies according to the presence and strength of training units. Usually there are from 500-2500 personnel present.
Temporary	326	16,938	Fair	The post is regularly used by Army and Air National Guard, the U.S. Army Reserve, the U.S. Marine Corps Reserve, and the Reserve Officer Training Corps. Camp Roberts is used by the Reserve Components for the conducting of inactive duty training most weekends throughout the year and for active duty training in the spring and summer. The post also receives Active Component use during selected periods.
	366	19,018		The full time staff during the annual training period is 53 employees and between 40 and 50 additional temporary employees. The staff is supplemented on weekends for annual training with an additional 56 personnel.
				Since 1971, the post has been engaged in a building rehabilitation program. All buildings in the program will receive new roofs, metal siding, concrete steps, new floors, walls, latrine fixtures, and improved electrical service. Only the buildings identified as required for support of National Guard training will be included in this program. The program will rehabilitate approximately 250 buildings by 1981. They were originally built in 1941 as 42- and 54-man barracks.

BACHELOR QUARTERS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CONDITION	REMARKS
			BACHELOR OFFICER QUARTERS	
Semi-permanent.	5	90	Fair	Built in 1941. At present only 21 of these buildings are in use.
Temporary	34	532	Fair	
Temporary	8	79	Fair	Female BOQ's.
	47	701		
			BACHELOR ENLISTED QUARTERS	
Temporary	8	217	Fair	

FAMILY QUARTERS

TYPE	NUMBER FAMILY UNITS	#BUILDINGS	CONDITION	REMARKS
			OFFICER AND NCO FAMILY HOUSING	
Senior Grade	1	1	Fair	General's quarters, reinforced concrete ranch house built in 1935. Wood frame building erected in 1941. This facility is located at the Nacimiento Ranch about 5.3 km (3.3 mi) along Perimeter Road to the SW of the main cantonment area.
Other Grades	1	1	Fair	Eighty-six spaces for house trailers (26 operational, 24 occupied, and 36 with no serviceable utilities) are available.
			GUEST HOUSING	
Temporary	34 spaces	3	Fair	Built in 1941-1943.

UTILITIES

CAPACITY AND CURRENT LOAD	REMARKS
ELECTRIC POWER	
Camp Roberts is served by 12 Kv overhead electrical lines. There is one substation with a capacity of 450 KW.	Electric power is supplied by the Pacific Gas and Electric Company (PG&E).
Maximum power deliverable per month is 3,240,000 KWH. Power consumption averages 363,700 KWH per month, with peak months of 697,200 KWH. Corresponding loads are 600 KW average and 1150 KW peak.	Electrical load is measured in 15-minute increments for billing purposes. The electrical system on post is now being upgraded in quality, but there are no plans to expand the system or increase its capacity.
PROPANE	
Main Garrison has two propane mixing plants with a total storage capacity of 378,530 liters (100,000 gal), which is limited to 321,725 liters (85,000 gals) because of pressure requirements. The plants have a output of 100,000 cubic feet per hour, 162 million BTU/hour.	These temporary plants were built in 1941. These plants will meet expected demands for the foreseeable future, and there are no plans to repair the East Garrison plant.
East Garrison has one abandoned butane plant with an output of 1,840,540 liters per hour (65,000 ft^3/hr or 700,000 BTU/hr).	The propane is delivered to the post by truck (9084 liters or 2400 gals each).
Average use per month for the period of Oct 1976-August 1977 was 126,040 liters (33,300 gal). Peak loads experienced: 113,264 liters per hour (4000 ft^3/hr) and 291,445 liters (77,000 gal) per month.	Supplier is constantly changing because the propane is bought on an open bid basis.
WATER SUPPLY	
Water sources are fourteen wells and ground storage tanks. Peak production capacity of the 9 operating wells is 7,948,500 liters radar (2.1 mgd). At present only 4 wells are normally used.	Of the 14 wells, only 9 are operational for water supply, and one is only operational for fire control in East Garrison. The tanks were built in 1941.
The water storage tanks have a capacity of 7,195,855 liters (1,901,000 gal). Normal storage is 2,460,250 liters (650,000 gal).	All water produced is chlorinated.
Average use varies from approximately 56,775 to 2,271,000 liters per day (15,000 to 600,000 gpd), with peak usage, before conservation restrictions of this year were imposed, reaching approximately 3,785,000 liters per day (1,000,000 gpd).	The present system is adequate for the near-term future and there are no plans for expansion.
SEWERAGE	
Camp Roberts is served by a treatment plant constructed in 1941 which has been partially rehabilited. This system has a design capacity of 11,355,000 liters per day (three million gallons per day).	The plant has a primary and secondary bio-filter system. Due to the breakdown of the secondary system, permits allowing for only 3,785,000 liters per day (1 mgd) are in effect today. Discharge can no longer be dumped into the river; therefore, the number of disposal pits limits output of the plant. Additional pits could bring the plant back to full capacity of 11,355,000 liters per day (3 mgd). Within 5 years, the plant will be upgraded to provide secondary treatment. With severe water conservation in effect, the peak and average sewage for this year are below normal.
Fifteen septic tanks and sewage pits.	
Average load fluctuates between 37,850 and 1,892,500 liters (10,000 and 500,000 gals) per day, with peak load experienced 2,838,750 liters per day (750,000 gpd).	
TELECOMMUNICATIONS	
Number of telephones and lines in use varies with the number of troops in training from a low of 90 stations to a high of 160. During summer periods when MLCH task force is in operation, an additional 26 stations are in use.	Camp Roberts has 97 kilometers (60 mi) of range communications lines.
Autovon lines vary between 4 to 7 lines. There are commercial lines available through Pacific Telephone and Telegraph. There are 10 trunk lines connecting the phones on post.	Pacific Telephone and Telegraph Company is in the process of installing a new dimensional telephone system for March 1978 operation. Initial capacity will be 200 lines. Complete dial system with 400 lines will be in place by December 1979. System will be owned and operated by PT&T.
The automatic dial system uses a three digit dial and has a 400-line capacity.	

SCHOOL FACILITIES

TYPE	CAPACITY	REMARKS
Elementary	N/A	There are no schools within Camp Roberts. Elementary Children, K-8, kindergarten through eighth grade attend school in San Miguel.
High School	N/A	High school children, grades 9–12, attend school in Paso Robles.

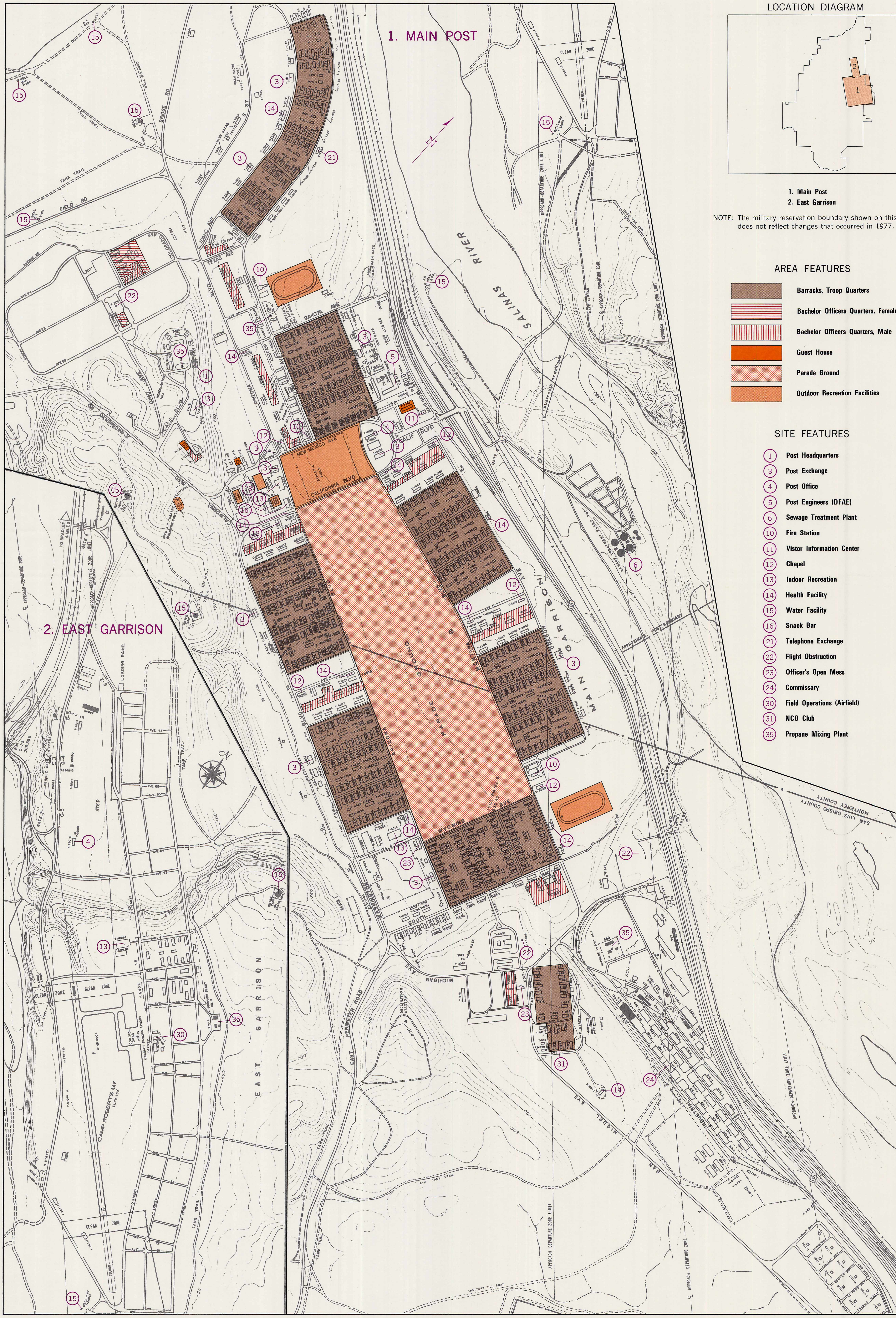
MEDICAL FACILITIES

TYPE	CAPACITY	REMARKS
Dispensary	14 beds	Seven temporary dispensaries without beds, with 1485 m^2 (15,988 ft^2) building area. These buildings were built in 1941.
		The main post dispensary, building #4050, is a new facility of concrete and concrete block construction with a composition roof and propane gas heat. It has 464 m^2 (5000 ft^2) with 14 beds, emergency facilities (including emergency surgery), and a helipad for medical evacuation.

RECREATION FACILITIES

TYPE	CAPACITY	REMARKS
Theater	No data	Two theaters with stages, built in 1941.
Swimming Pool	No data	Outdoor swimming pool, built in 1945.
Athletic Field	No data	
Bowling Center	No data	One bowling center has 8 lanes.
Tennis Court	No data	Built in 1941.
Open Air Theater	No data	Built in 1941 with a capacity of 20,000 persons; actually a hillside which can hold up to 40,000 persons.
		Open year round: Officers open mess, EM club, main PX, gymnasium, service club, library; Open May to October: swimming pool; open summer: theater, snack bar, service station, and post office. There are no plans to expand these facilities.

CAMP ROBERTS, CALIFORNIA
URBAN AREAS (CANTONMENT AREAS)



1. Main Post
2. East Garrison

NOTE: The military reservation boundary shown on this map does not reflect changes that occurred in 1977.

AREA FEATURES

- Barracks, Troop Quarters
- Bachelor Officers Quarters, Female
- Bachelor Officers Quarters, Male
- Guest House
- Parade Ground
- Outdoor Recreation Facilities

SITE FEATURES

1. Post Headquarters
3. Post Exchange
4. Post Office
5. Post Engineers (DFAE)
6. Sewage Treatment Plant
10. Fire Station
11. Vistor Information Center
12. Chapel
13. Indoor Recreation
14. Health Facility
15. Water Facility
16. Snack Bar
21. Telephone Exchange
22. Flight Obstruction
23. Officer's Open Mess
24. Commissary
30. Field Operations (Airfield)
31. NCO Club
35. Propane Mixing Plant

Approximate Scale 1:7,200

1000 500 0 1000 2000 FEET

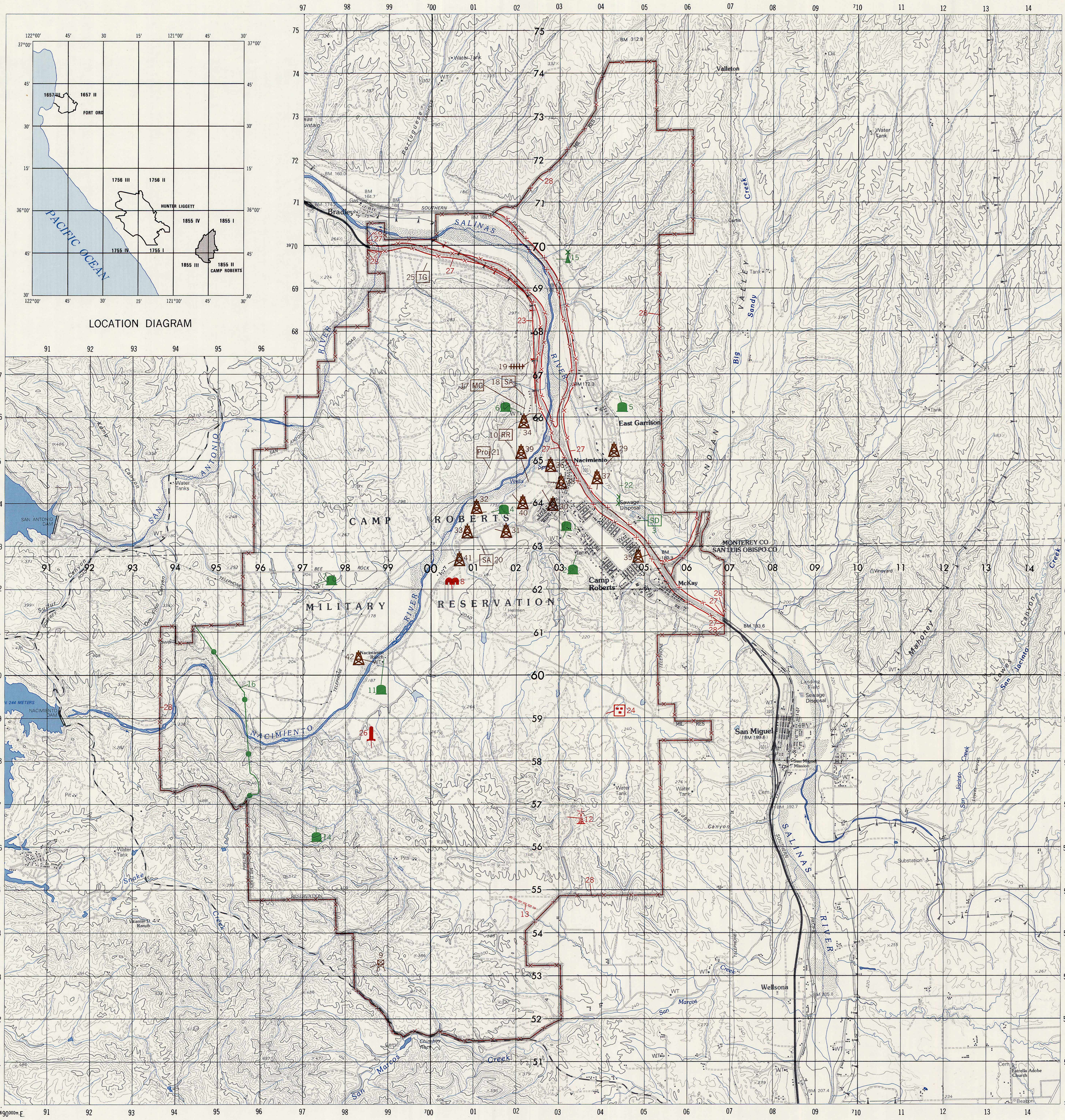
500 0 500 METERS

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

L. NON-URBAN CULTURE FEATURES

On the Camp Roberts Reservation, there are some 42 man-made features outside the cantonment area, which could affect military training or operations either positively or negatively. Most of these features depicted on the accompanying map and described below, consist of water tanks and small buildings associated with the various ranges. The man-made features included are those that existed as of 1 December 1975, except well data, which are as of 1977.

MAP NUMBER	GRID REFERENCE	DESCRIPTION
1	031632	Water Tank, building #122, height 8.8 m (29 ft), diameter 18.4 m (60.5 ft), capacity 2,415,000 liters (628,000 gal)
2	034628	Water Tank, building #123, height 8.8 m (29 ft), diameter 18.4 m (60.5 ft), capacity 2,415,000 liters (628,000 gal)
3	048636	Sewage Disposal Plant, design capacity of 11.4 million liters per day (3 million gpd), height of highest tank 6.5 m (21.3 ft)
4	014638	Water Tank, height 8.8 m (29 ft), capacity and status — no data
5	044665	Water Tank, building #28028, height 8.8 m (29 ft), diameter 18.4 m (60.5 ft) capacity 2,415,000 liters (628,000 gal)
6	021661	Water Tank, building #14807, height 5.5 m (18 ft), diameter 7.3 m (24 ft), capacity 113,500 liters (30,000 gal)
7	973621	Water Facility capacity and status — no data
8	005620	Ammunition Storage Facility — 12 igloos, 679 m^2 (7200 ft^2)
9	986532	Tower, height 20 m (65 ft)
10	019653	Rifle Range
11	989604	Water Tank, building #16009, height 2.7 m (9 ft), diameter 2.7 m (8.75 ft), capacity 15,900 liters (42,000 gal)
12	032567	Strategic Communication Station facilities building and three dish antennas — height of tallest 26.7 m (87.8 ft)
13	023547	Airstrip, 425 m (1402 ft) x 12 m (40 ft), dirt (abandoned)
14	973565	Water Tank, height 5.6 m (18.4 ft), capacity and status — no data
15	029697	Windmill, no data
16	From 945612 To 956570	Underground Pipeline (oil), Mobil Oil Corporation
17	022662	Machine Gun Range
18	022665	Small Arms Range
19	023673	Revetment, approximate length 300 m (984 ft), approximate height 4.0 m (13 ft)
20	012630	Small Arms Range
21	014648	Projectile Range
22	044642	Elevated Sewer Pipeline, 3.7–4.6 m (12–15 feet) above river
23	From 000702 To 024664	Electric Power Line (12 KV) — no data
24	041591	Mock Village, no data
25	999696	Tank Gunnery Range
26	986583	Silo, height 8.85 m (29 ft)
27		Fence, barbed wire, four-strand, approximate height 1.2 m (4 ft)
	From 985699 To 069612	
	From 985701 To 069614	
28		Fence, chain link, approximate height 2.4 m (8 ft)
	From 985699 To 069612	
	From 985701 To 014707	
29	041649	Water Well B2, maximum daily capacity 1,136,000 liters (300,000 gal), slightly high in sulphur
30	026643	Water Well C1, maximum daily capacity 1,476,000 liters (390,000 gal); this well has mechanical problems
31	015634	Water Well C3, maximum daily capacity 852,000 liters (225,000 gal)
32	013638	Water Well C4, maximum daily capacity 852,000 liters (225,000 gal), high sulphur, sand
33	011632	Water Well WC5, maximum daily capacity 1,325,000 liters (350,000 gal)
34	026661	Water Well W6A, maximum daily capacity 170,000 liters (45,000 gal), limited use
35	051628	Water Well W1, maximum daily capacity 1,684,000 liters (445,000 gal)
36	025648	Water Well W3, maximum daily capacity 1,628,000 liters (430,000 gal)
37	039643	Water Well 5A, maximum daily capacity 1,136,000 liters (300,000 gal), mechanical problem
38	027645	Water Well W6, maximum daily capacity 2,460,000 liters (650,000 gal), radio active, sand-closed
39	023645	Water Well W11, maximum daily capacity 1,363,000 liters (360,000 gal), sand
40	019642	Water Well W12, maximum daily capacity 2,157,000 liters (570,000 gal), seasonal-high salt
41	004626	Water Well W13, maximum daily capacity 606,000 liters (160,000 gal), mechanical problems
42	987603	Water Well W14, maximum daily capacity 852,000 liters (225,000 gal)



CAMP ROBERTS, CALIFORNIA
TERRAIN ANALYSIS

Scale 1:50,000

Meters 1000 500 0 1 2 3 4 5 Kilometers

1 ½ 0 1 2 3 Statute Miles

CONTOUR INTERVAL 20 METERS
SUPPLEMENTARY CONTOURS 10 METERS

NON-URBAN CULTURE FEATURES

Water Tank	SA Small Arms Range	Revetment
SD Sewage Disposal Plant	Proj Projectile Range	Aqueduct (elevated)
Water Well	TG Tank Gunnery Range	Power Line
Ammo Storage Facility	Radio Tower	Mock Village
Tower	Airstrip (abandoned)	Silo
RR Rifle Range	Windmill	Fence
MG Machine Gun Range	Pipeline (underground)	

NOTE: The military reservation boundary shown on this map does not reflect changes that occurred in 1977.

NOTE: Number on map refers to entry in table.

Prepared by the Defense Mapping Agency Hydrographic/Topographic Center, Washington, D.C. for the Terrain Analysis Center, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. June 1980.

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